RAILROAD GAZETTE

FRIDAY, MARCH 19, 1897.

CONTENTS

Steel Tired Wheels—A Correction.

In our last issue, in the article on the New Steel Tired Wheel Company, we said "the Krupp Wheel business as represented by Messrs. Thomas Prosser & Son will also be controlled." This is not true. The new company exercises no control over the sale of the Krupp wheel in this country. This statement should not have gone into our article, because we knew at the time the paper went to press that it was not true, but through a mistake in the printing office the correction in the proof was not made.

Contributions.

Traffic in Railroad Education.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with unusual interest the report of January meeting of the New York Railroad Club. I am amused at the one-sidedness of many of the views expressed—the extent to which men in any one branch of the profession view the general question from the point of vision of their own branch exclusively. This reminds me of the tale of the three blind men of India. I observe how tenderly the question of traffic education was handled, or rather how universally it was shied at by all but yourself.

I still believe that while neither a traffic manager nor a chief engineer can be created in a college course, fully as much, and very likely more, can be done toward the former than toward the latter; and I very firmly believe that the country's traffic offices need college-bred more than its engineering offices. I hope you will continue the discussion in the *Railroad Gazette*. There is much to be said.

GENERAL FREIGHT AGENT.

Suburban Competition.

18 S. BROAD STREET, PHILADELPHIA.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The article by my colleague in the American Society of Civil Engineers, in your issue of 12th inst., on the above topic, suggests important requirements which engineers and inventors have been striving to fulfill for many years past and the evolution has been rapid and satisfactory, although your writer closes his paper with the remark that he "is not advocating any particular system, for there is none now generally known that will meet the requirements," and he adds there is not one of the electric systems suitable to the conditions indicated in this article. "The overhead trolley and the third rail are not to be considered. . . . There is little doubt that a suitable system can be found," etc. The drift of the article looks toward a solution in the direction of an *independent* electrical motor attached to each pair of wheels, so as to eliminate the connection with a power-house. This goal has been sought for by many inventors for years through storage batteries, etc., but without practical success, and it is evident that a motor which may be operated by a fluid as free as air, possessing great elastic force, safety, freedom from loss in transforming and applying and which may be stored without waste, must fulfill the required conditions as nearly as anything can that be desired, yet your correspondent sweeps this out of sight with the broad assertion that "one railroad manager had a hope that compressed air would solve the problem, but air is a gas and so is steam, and it is equally incomprehensible how an engine propelled by one kind of gas is better than one using another kind of gas in facilitating the handling of cars. The fundamental method must be changed."

So long as a motor is used to draw a *train*, just so long, it seems to us, it will make no difference between steam, air, electricity or other power as to the facility for handling independent cars, which seems to be the author's point, unless each car is a self-contained unit of power for "trunk line" service, and this we believe would greatly increase the cost, hence is a retrograde and impracticable movement. The great strides, however, which have been made in the intelligent application of compressed air after 27 years of study and experience lead to the belief that in many departments of mechanics and dynamics it will supersede steam or electricity, and give better service at less cost.

Within a month it is expected that a compressed air locomotive will be in operation on the Sixth Avenue line. It has been completed for some months and is running at Rome, N. Y., while the compressor plant is being erected at 110 Greenwich street, New York, for the installation of this system, and street car motors are and have been in successful operation continuously for over seven months on 125th street, New York, through all phases of weather, with entire satisfaction and great economy. This system would seem, therefore, to come as near as anything at present available to the fulfillment of the requirements stated by your correspondent, for it will not be found economical to run trunk lines in detached units, as he suggests.

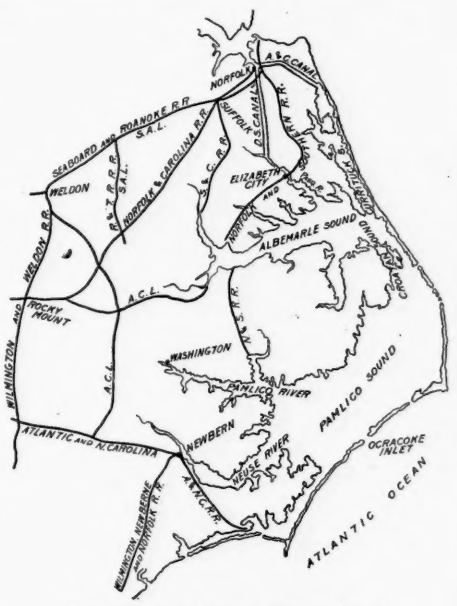
HAUPT & FRANKLIN, *Consulting Engineers*

The Dismal Swamp Canal.

NORFOLK, Va., March 12, 1897.

TO THE EDITOR OF THE RAILROAD GAZETTE:

For the sake of righteousness, kindly allow me to edit out some of the errors of the article entitled "The Dismal Swamp Canal," in your issue of the 5th inst, p. 168.



The Region of Dismal Swamp Canal.

Ocrakoke is an inlet to Pamlico and not Albemarle Sound. It is the only remaining one, of about seven, navigable for vessels of more than 6 ft. draft; it now has about 9 ft., the government having dredged the channel for the last two years; drifting sands of the beach have either entirely closed or shoaled all the others. Albemarle and Pamlico sounds would disdain any artificial aid in keeping open their channels, both having two fathoms of water and upward.

Not so, however, with Croatan Sound, about 12 miles long and from three to five wide. This sound connects Albemarle and Pamlico, and through it, as a lane, the northerly and southerly winds drive the water to and fro from the sounds above and below. The alternating currents have shoaled this sound until there is now only eight feet of water in ordinary stages.

This, therefore, like the governing grade of a railroad, limits the draft and capacity of all vessels bound between the inlet or rivers of Pamlico Sound and the canals; and its remedy is beyond any practicable expenditure.

Dismissing the imaginative flight about 12,000 miles (one 0 too many) of navigable waters in Eastern North Carolina; of 10-foot barges pursuing the little three-foot river steamers; of their carrying vegetables (which prefer refrigerator cars), cotton or even naval stores, all of which move by rail; of the commerce of the South Atlantic States deserting coastwise steamships and vessels for light-draft barges in order to sustain the projected canal when it could have gone through the Albemarle & Chesapeake Canal for the past 10 years, but did not; consider several cold facts and conclude if 22 miles of canal is likely to be any more tangible than its fancied traffic.

In the 30 counties of North Carolina traversed by the Wilmington & Weldon Railroad and east thereof, the only artificial outlets of commerce in 1880 were 96 miles of the Atlantic & North Carolina Railroad, running west to the Wilmington & Weldon, and the Albemarle & Chesapeake Canal. In 1890 there were 716 miles of standard-gage railroad in the same territory, an increase (exclusive of the Wilmington & Weldon) of more than 500 per cent. During the same period the population increased about 6½ per cent., and the staple products, corn, cotton, peanuts, tobacco, etc., increased about an average of 80 per cent. Except the Wilmington & Weldon none of these lines paid a dollar of dividends and some did not pay interest.

The railroads immediately altered the traditional carrying methods; Western products that used to move via Baltimore, down the bay and through the canal, are now distributed directly all rail; no perishable freights, *i. e.*, vegetables, fresh fish, etc., hazard the uncertainties of the canals, all going by express or fast freight. The fleet of steamboats which used to be operated by the Old Dominion Steamship Co. and others between these waters and Norfolk and Baltimore is reduced to a half dozen small boats of 150 tons and less. The products of the region are all marketed by rail, and the traffic through the canal is chiefly rafts of pine logs, and lumber in barges and vessels which carry out fertilizers, lime, coal, salt, etc. There are a number of steamboats in these waters, but they are confined there in connection with the railroads.

The Albemarle & Chesapeake Canal is 8.44 miles long with 8 ft. of water, and one lock 250 ft. long and 40 ft. wide; this is a tidal lock, *i. e.*, at four times daily the water is of the same level each side of the lock when the gates are opened and rafts, tows of vessels, etc., pull through without disturbing formation. The projected canal, being a summit level one, would require the rafts and tows to break up to lock through two locks, which will be prohibitory.

The prospectus leaves several matters unexplained. It is all clear about the 22 miles of canal and two locks, 10 turnouts, bottom width, depth, steel gates, etc., from the village of Deep Creek to the village of South Mills, at an estimated cost of, say, $1,200,000; but it don't provide for improving eight or ten miles of creeks at the ends, through which only can access be had from the Elizabeth and Pasquotank rivers, but that is another story, as Kipling says.

Neither does it suggest how fixed charges on $1,200,000, taxes and cost of operating and maintaining 22 miles of canal and two locks are to be obtained in competition with a rival canal 8½ miles long, with as much depth of water as there is in Croatan Sound, one lock and just about to be relieved of a seven per cent. bond. Not an altogether inviting field is it? Nevertheless it was keenly scrutinized 20 years ago.

About 1875 the then owners of the two canals had a sharp contest to persuade the government to select their respective routes for the expenditure of the money about to be devoted to improvement of the public waterways between Norfolk harbor and Albemarle Sound. Congress finally ordered a comprehensive survey to ascertain the comparative merits of the two routes; this survey was made in 1878 and 1879 by Capt. C. B. Phillips, U. S. Engineers, who reported in 1880. The relative distances by the two routes between common points in Norfolk harbor and Albemarle Sound are:

By the Dismal Swamp line	72.84 miles.
" " Albemarle & Chesapeake line	72.71 "

It was proposed to make a waterway by either line of 80 ft. bottom width and 9 ft. deep. To do this would cost, it was estimated, by the Albemarle & Chesapeake Canal with one lock, $509,701, and by the Dismal Swamp Canal with four locks, $1,483,646.

The engineer directly in charge of the survey concludes his report as follows:

"From the foregoing it will be seen that our estimates for the improvement of the Dismal Swamp Canal are greatly in excess of those for the Albemarle & Chesapeake Canal. The cost of four locks which will be necessary for the proper improvement of the Dismal Swamp Canal forms no inconsiderable part of the total estimate, and inasmuch as this is a summit level canal whose length is more than twice that of the Albemarle & Chesapeake Canal, which is practically a tidewater canal, it becomes plainly evident that, whatever the plan we may adopt for the improvement of the two, if we seek to give the same sectional waterway and the same dimensions of locks to each, the estimates for the summit level must necessarily be the greater."

The line of the Albemarle & Chesapeake Canal was adopted by the government for improvement, and the subsequent appropriations, including the fiscal year 1896, amount to $277,000.

Apparently the men then in control of the Dismal Swamp Canal were wiser in their generation; if they could not induce a paternal government to rebuild their canal, then anyone, more enthusiastic than they, might have it—and got it.

CROATAN.

Some Questions of Locomotive Performance.

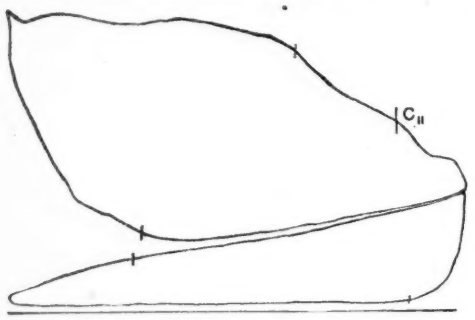
In our issue of Jan. 22 appeared a very short account of a run made by a Vauclain compound locomotive of the Atlantic type, No. 839, on the Chicago, Milwaukee & St. Paul, from Chicago to Milwaukee. *The Engineer* (London), in its issue of Feb. 12 professes to believe that this run really was made at the speed given, but finds the demand on its faith very considerable and begs that we give in future "some assurance to our numerous English readers that due editorial care has been used to secure accuracy." We are informed that if the statements made are really true there must be some peculiarities in railroad working in the United States unknown to the rest of the world. The editor, with that skepticism with regard to all American feats for which he is famous, says:

"The conditions under which locomotives work in the United States appear to present occult radical differences from those prevailing in this country. Can no one throw any trustworthy light on the nature of these differences?

With vague statements that adhesion is greater, resistance less, and so on, we are quite familiar. Granting, for the sake of argument, that they are true, we still want to know why the coefficient of adhesion is greater and why the resistance is less, and, above all, some definite scientific proof that adhesion must be greater and the resistance must be less."

We have asked Mr. Vauclain, the designer of the locomotive, who was present and rode on the locomotive during the run in question, to try to show that the performance of that engine is quite consistent with well-known mechanical laws, and his communication on the subject appears below. First, however, we may summarize briefly some of the points which the English editor has raised.

A train weighing, with the engine and tender, a little over 535 long tons (1,200,090 lbs.) ran from Chicago to Milwaukee, 85 miles, in 112 minutes. In the 74 miles of fairly clear running there were four places where speed had to be reduced and one full stop, and on July 3, when the run was made, this stop amounted to five minutes.



Card No. 37.—53.7 miles per hour, 215 revolutions per minute. Mean effective pressure: high pressure cyl., 89; low pressure, 35.5. Horse power: high pressure cyl., 666.8; low pressure, 761.8; total, 1,428.6. Tractive power: high pressure, 4,656; low pressure, 5,318; total, 9,974. Water rate from card: At cut-off, 15.36; at release, 14.54; at expansion line low pressure card, 15.77; at point C,,, 15.48.

Nevertheless, the train made that distance (74 miles), including the slacks and the stop, in 82 minutes, or 54.2 miles an hour. The engine and others almost precisely like it have been several times described in these columns.

The editor assumes the coefficient of adhesion at about $\frac{1}{6}$; then the tractive effort of the engine is limited to five tons, or $\frac{1}{107}$ of the total weight moved. This represents 21 lbs. per ton, which must have sufficed to haul the train at the speed given.

The editor picks out the portion of the run between Russell and Lake, nearly 31 miles, which was made in 36 minutes, including a stop of five minutes, to say nothing of a reduction of speed, leaving the time in motion 31 minutes, or 60 miles an hour. He says that with one short exception the line rises the whole way from Russell to Lake, and that the last five miles rise at a rate of 1 in 203. The easiest incline is 1 in 400.

"Gravity alone represents on the first incline over 11 lbs. per ton; on the last-named grade it stands for 5.6 lbs. per ton; deducting these from 21 lbs., we have 10 lbs. and 15.4 lbs. respectively left as representing the axle and air and track resistance of a train whose speed must have considerably exceeded 60 miles an hour on portions of the run. It is hard to believe that the resistance was so small. On the other hand, however, an effort of five tons moving at 60 miles an hour represents 1,800 indicated horse power. That is to say, one indicated horse-power per 1.25 sq. ft. of heating surface, and this with a non-condensing engine! The average cylinder pressure must have been high, and, making every allowance for compounding, is it safe to assume that the engine used less than 18 lbs. of steam per indicated horse-power per hour? But this involves the assumption that every square foot of heating surface evaporated 14.4 lbs. of water per hour, a most marvelous and unparalleled performance for a locomotive boiler.

"It may be said, of course, that our arguments all turn on the coefficient of adhesion, and that our difficulties are based on it. This is, to a large extent, true; but the difficulties are none the less real, nor is the question for discussion less important. Was the resistance of this train at any time less than five tons? So far as we can judge it must always have been in excess of five tons. The total weight moved was enormous. At this side of the Atlantic we have nothing that can be used for comparison. No one attempts to draw trains weighing 535 tons with an adhesion weight of 31 tons only. We admit frankly that it cannot be done in this country save at slow speeds and on a level. In the United States it seems that 31 tons of adhesion suffice to take 535 tons up a rather steep incline at 60 miles an hour. How was it done?

"Not many years ago an American contemporary, dealing with questions of train resistance published a report on certain dynamometer experiments, which showed that little more than one-half the indicated power of the engine reappeared in the train; in a word, half the power of the engine was expended in propelling the engine and tender. On this basis we should in the case under notice have only about 3 tons left to haul 435 tons of train, or $\frac{1}{145}$ of the weight, and this up inclines the resistance of which represented $\frac{1}{264}$ of the weight. Can it be possible that about 15 lbs. per ton sufficed for everything? The only way out of the difficulty is to imagine that the coefficient of adhesion must have been much in excess of one-sixth.

"The Vauclain compound appears to English eyes badly designed; there is a want of proportion about it; there is a boiler equal in power to the boilers of two English locomotives, while the adhesion provided is that of one English engine.

"In a word, assuming that No. 839 really took 535 tons up inclines of 1 in 400 to 1 in 204, at 60 miles an hour, we want to know how it did it. There was one excellent reason why the work could not have been done, viz., lack of sufficient adhesion. A load of 31 tons on wheels only 6 ft. 6 in. in diameter is not sufficient to utilize 2,245 sq. ft. of heating surface and an enormous grate. Some of the Great Western broad-gage engines had, it is true, 2,000 ft. of surface for only 15 or 16 tons of adhesion, but the wheels were 8 ft. 6 in. in diameter, the pressure only 120 lbs., and the total loads about half that of the American engine."

Mr. Vauclain states in his communication that the grades assumed by the English editor as controlling are for very short distances and gives the total ascent between the points. We regret that the editor should have been misled by the very inadequate profile which we published. Although the profile bears the statement that the grades given are maximum grades it is certainly misleading as to the portion of the line in which these maximum grades occur. In fact, between Russell and Lake there is only about 2¼ miles of 26-ft. grade and in the last five miles of that run, which the editor especially considers, there is only 1¼ miles of grade so steep. The total rise in this five miles is only 44 ft. and that five miles is immediately preceded by 4½ miles of level or of descending grade, the last slope on the descending grade, 1.3 miles, being at 35 ft. to the mile.

In the whole 74 miles above mentioned the highest summit passed is about 131 ft. above the altitude at the beginning of the 74 miles, and that is attained in 57 miles of undulating and easy grades, the steepest being 26 ft. to the mile.

Mr. Vauclain writes: "I feel it my duty to reply to the argument of our English friend, partly because the report was sent to me by the Chicago, Milwaukee & St. Paul officials, and partly because I was present in person, riding on the locomotive and directing its operation, and therefore well capable of discussing the matter.

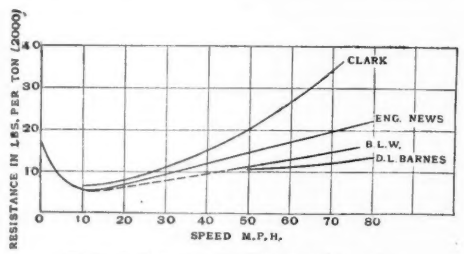
"In the first place, our friend comments upon the haphazard manner in which information is given to reporters of the daily American press and upon its worthlessness for scientific purposes. The article which he discusses was not printed in the daily press, but in the columns of a supposedly esteemed contemporary. The data were not furnished by a casual observer, or train hand, and given out as assumed, but were carefully and accurately arranged by the Mechanical Department of the Chicago, Miwlaukee & St. Paul Railway in a very impartial manner. The notes that I succeeded in taking myself indicated slightly better work at some points of the trip than is credited to the engine, but I was perfectly satisfied with the report as it was sent to me.

"Our friend seems to doubt that the statement is really true; or if it is true he considers that there is something in railroad working in the United States which should be discovered, defined and explained and adopted in Europe. There is, of course, nothing in the report that cannot be verified by calculation, which I shall gradually make clear as I proceed.

"His description of the engine is very good, excepting that she carries 32 tons on the drivers instead of 31. He speaks of the enormous boiler and grate surface. It is evident that he is not familiar with the requirements of a locomotive for such excessive service. High speed with heavy trains is obtainable more by the use of large heating surfaces, than by weight on the driving wheels. Furthermore, this boiler was designed to burn coal found in the State of Illinois, capable of evaporating about 5 lbs. of water per pound of coal, also to furnish steam for heating the train and running the electric light plant, in addition to the steam required for the hauling of the train.

"Further on, our friend asks the question, 'Can all the work be utilized?' He assumes a coefficient of adhesion of one sixth. In America we calculate on being able to use a coefficient of one-fourth under good conditions, and never less than one-fifth. That we are correct has been demonstrated by several tests made recently both in freight and passenger service. Therefore the total available tractive power would be 8 tons, instead of a little more than 5.

"This amount of tractive power, however, is not required for the work under discussion. Your contemporary picks out that portion of the road between Russell and Lake. The diagram shown in your paper, which has been reduced for publication, does not show all of the variations in the track between these two stations. Russell is 92.5 ft. above Lake Michigan; Lake is 154.5 ft. above Lake Michigan, making a total rise in 31 miles of 62 ft., or an average ascending grade of 2 ft. per mile. This distance was made at an average of 60 miles per hour, excluding the stop. By referring to the enclosed chart, showing the resistance in pounds per net ton, on the level, of passenger trains at various speeds and miles per hour given by the following authorities, D. K. Clark, Eng. News, Baldwin Locomotive Works, and Mr. D. L. Barnes, you will notice how closely our calculations for in resistance compare with those made by Mr. Barnes



Train Resistance for Different Speeds.

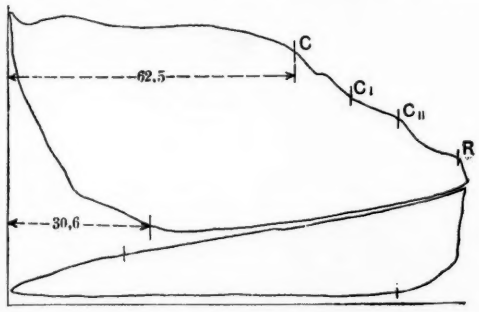
Atmospheric conditions would probably make this difference, which is only 2 lbs. per net ton at a speed of practically 80 miles per hour. The resistance shown in our calculations had been arrived at from a series of high speed passenger tests made especially for this purpose, and we base our calculations upon it. From this we find that the average resistance of this train for the 31 miles between Russell and Lake would be about 15.15 lbs. As one stop was made in this distance we can safely assume that an average of 16 lbs. was expended per ton of train between the points mentioned, or a total of 9,560 lbs. tractive power. The maximum tractive power of the engine being 18,000 lbs., it will be noticed that slightly over half of the weight on the driving wheels was utilized; therefore there is no peculiarity connected with this performance.

"The hardest section of the road, however, is from Forest Glen to Western Union Junction, a distance of 51.8 miles; time consumed, 55 minutes, four slow-downs included. This would require an average speed of about 60 miles per hour, including the time lost in slowing down. Forest Glen is 31 ft. above Lake Michigan: Western Union Junction is 144.4 ft. above Lake Michigan, giving a total rise in the 51.8 miles of 113.4, which would average about 2.2 ft. per mile ascending grade. This would require an average of about 15.3 lbs. of tractive power for each ton of train for the entire distance. The reason this portion is considered the hardest on the road is that the slow-downs occur at the foot of ascending grades.

"Our friend assumes a maximum tractive effort possible of 21 lbs. per ton. Suppose we admit that at certain points on the various grades this amount of tractive power is utilized, the question arises, 'Could the engine develop this tractive power at 60 miles per hour?' The horse power would be $\frac{11235 \times 60}{375} = 1{,}798$ H.P.

The total heating surface of the engine is 2,244.5 sq. ft., which divided by 1.25 (being the heating surface necessary to produce an indicated horse-power on our compound engines) we have as a result 1,795.6 H. P., or practically the same as called for by a resistance of 21 lbs. per ton at 60 miles per hour, which shows that the *boiler* is large enough to do the work.

"Our friend questions that a locomotive boiler can furnish an indicated horse-power for each 1.25 sq. ft. of heating surface. To substantiate this statement I send you a few original diagrams taken from a similar compound high speed engine on the Philadelphia & Reading R. R., between Philadelphia and Atlantic City, the cylinders of which were of the same dimensions exactly



Card No. 39.—53.7 miles per hour, 215 revolutions per minute. Mean effective pressure: high pressure cyl., 85.5; low pressure, 31. Horse power: high pressure cyl., 640.6; low pressure, 729.6; total, 1,370.2. Tractive power: high pressure, 4,472; low pressure, 5,093; total, 9,565. Water rate from card: At cut-off, 15.39; at release, 14.36; at expansion line low pressure card, 16.03; at point C,, 15.32; at C,,, 15.86., at R, 14.36.

as those of engine No. 839, but whose driving wheels were 6 in. larger in diameter. The total heating surface was 1,835 sq. ft. Card No. 37 shows 1,428.6 H. P. indicated, or an indicated horse-power for each 1.28 sq. ft. of heating surface contained in the boiler. These cards were taken on a comparatively slow run, and do not indicate the maximum capacity of the engine. The train consisted of 12 cars, 4 Pullman parlor cars and 8 ordinary American coaches. This same locomotive has hauled 17 cars, mostly American coaches, between these points in the same service. This should be sufficient to substantiate our figures.

"Now let us refer to the five miles of grade at Lake, to which our friend particularly calls attention. All of the grades shown in your published diagram are the maximum grades between those stations between which the figures are placed, and the reader is so informed by the words in plain English to the left of the diagram. The average grade between these points depends upon their respective heights above Lake Michigan. The maximum grade, for instance, between Oakwood and Lake is 26 ft. per mile. Oakwood, however, is 110.5 ft. above Lake Michigan, and Lake is 154.5 above Lake Michigan, making a total rise in the distance of five miles of 44 ft., or 8.4 ft. per mile average grade. The total train resistance then would be 17.9 lbs., or say 18 lbs. per ton, which you will notice is well within the capabilities of the engine under discussion.

"Our friend complains of the mental effort required to believe all of the various (to him) impossibilities of this performance. In addition to the impossibilities I have already fully explained, he questions the indicated water rate per horse-power, and the evaporative efficiency of the boiler. If you will refer to card No. 39, enclosed herewith, you will notice that the maximum indicated water rate under

these conditions, and which occurs at the low-pressure release, is 16.03 lbs. per horse-power, which is well within his figure of 18 lbs., supposed by him to be impossible. As to the evaporative efficiency of Baldwin boilers on Vauclain compounds, take the case of diagram No. 37—1,428.6 H. P., at the maximum rate of 16.03 lbs. of water per indicated horse-power, would give 22,900 lbs. of water, or 12.5 lbs. of water per square foot of heating surface per hour indicated. The engine at the time this card was taken was not doing its maximum work. In consequence of this our friend must admit one of two things—either that our water rate is lower than 16.03 per indicated horse-power, or that our evaporation per square foot of heating surface is fully equal to his impossible figure of 14.4 lbs. If this is not sufficient, the following data will settle the matter:

"On the 4 p. m. train between Philadelphia and Atlantic City, a distance of 55.5 miles, one of our trial runs in regular passenger service was made from bell pull to dead stop in 48 minutes. The injectors were in action 42 minutes. The water consumed was 2,688 gals. The average throw of the injectors during this time was 62 gals. per minute, or at the rate of 31,000 lbs. of water per hour, which, divided by the total heating surface of 1,835 sq. ft., would show the *actual evaporation* to be 16.9 lbs. per sq. ft. of heating surface. Further, the injectors were each capable of throwing 75 gals. of water per minute at 200. lbs. pressure. The train covered 38 miles of this distance in 27 minutes and 58 seconds, ranging from 44 to 50 seconds per mile, during which time it was frequently found necessary to apply the second injector. I leave it to our friend to guess what the maximum evaporation per square foot of heating surface was when the engine was doing her hardest work, or during this portion of the run.

"I have now, I think, explained everything fully to our incredulous friend. I am disposed to take no offense at his comments upon the bad design and lack of proportion of this locomotive. As locomotive builders we think we understand our business, and that it is not necessary for us to resort to what is considered the best English practice in order to build satisfactory and desirable locomotives. The fact that we have already built and distributed over the world in almost every country nearly 16,000 locomotives, and that we have an annual capacity of 1,000 locomotives, is sufficient to warrant us in being willing to assume all the responsibility for the design and proportion of this locomotive for the service for which it was intended. It must also be understood that the service above described is not exceptional; that it was made in regular schedule service in which the engines have been constantly engaged since being placed on this road, making a mileage of over 10,000 miles per month. I should be glad to have our friend pay me a visit in the United States, and he could then satisfy himself from personal observation that engines of this class are capable of doing the work you describe."

A Car for Fire Protection.

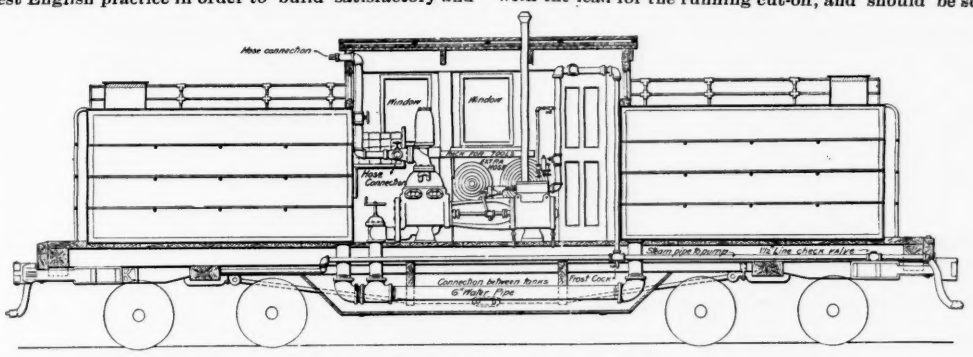
Our illustration represents the fire car used at the East Buffalo yards of the New York Central for the protection of the company's property. The car is 34 ft. long and strongly built, and has two water tanks, one on each end. The capacity of each tank is 3,500 gals. The pump is placed in the middle of the car between the tanks. Over the pump there is a well-arranged cab, forming a pump-house.

The car is equipped with one Fairbanks & Morse duplex fire pump, with 12 × 12 in. steam cylinders and water cylinders 8 × 12 in. The water discharge is arranged for three 2½-in. hose connections, so that three streams can be used at one time. The steam for running the pump is supplied by the locomotive used to draw the car. The car is equipped with the company's standard Sewall steam hose connection, so that any available engine can be used to operate the pump.

The hose used with the car is 2½ in. linen fire hose, and the opening in the nozzle is 1 in. The hose rack is close to the water connection, and the hose is at all times attached so that it can be run out of a window on either side of the car. There are also two reels carrying 300 ft. of extra hose. With a pressure of 80 lbs. of steam and a 1 in. nozzle, and throwing through 100 ft. of hose, the distance of stream as taken from time to time has been from 160 to 170 ft. With one such stream working, the capacity of the tanks lasts on an average from 50 minutes to one hour.

As switch engines are working close to where the car is kept, and at night one is always attached to it, so far the company has never failed to have the car ready for service in five minutes.

Mr. James Macbeth, Master Car Builder, N. Y. C. & H. R., to whom we are indebted for these particulars, says that from personal observation he has noted that when this car has been working alongside of the city steam fire engines, it has always been able to surpass them in duty.



Fire Car Used at the East Buffalo Yards of the New York Central.

Lead for Locomotives.*

PASSENGER LOCOMOTIVES.

Full Gear.—Probably 99 per cent. of the men in the mechanical departments of our railroads believe a locomotive must have positive lead that it may be "smart," advocating from $\frac{1}{32}$ in. to $\frac{1}{8}$ in., the majority preferring $\frac{1}{16}$ in. for all classes of engines. It will require but little investigation to demonstrate the fallacy of this common belief. An engine will be smart in direct proportion to the power it develops; its power will be increased only by increasing the average cylinder pressure or reducing the internal friction. The valve travels rapidly in full gear, the piston moves slowly and the lead is such a small part of the maximum port opening that the average cylinder pressure will be affected but little by any change of lead from $\frac{1}{8}$-in. positive to the same amount negative. What slight change there may be will be in favor of the negative lead because reducing the lead in full gear increases the full gear cut-off. Positive lead, as usually given, appreciably decreases the maximum power because it admits steam to the cylinder before the piston reaches the end of the stroke, producing negative power and considerably increasing the friction of the bearings. Because of the slow speeds at which full gear cut-off is used, it is evident that lead is not needed for a cushion.

The lead in full gear, provided it is not more than 1-16-in. positive, is of minor importance when compared with the lead for the running cut-off, and should be set chiefly with a view to securing the best lead for the cut-off with which most of the work is done.

Running Cut-Off.—It is evident that the lead may be made so great as to allow steam to enter the cylinder before the piston reaches a point several inches from the end of the return stroke and that such an adjustment will produce excessive compression, largely destroy the power of the engine, and result in useless shock, heating, wear and delays. It is equally clear that, since the lead is ordinarily from 80 to 90 per cent. of the maximum port opening, it may be reduced to such an extent as to make the engine practically powerless. Between these extremes there must be a lead which will give the maximum power and least shock. On the various types of engines commonly used there is considerable difference in the rate at which the full gear lead increases as the cut-off is shortened. For this reason it will require no extended argument to prove that the best lead cannot be secured by the all but universal practice of fixing the lead for full gear, regardless of the lead produced in the running cut-off, and making the full gear lead the same for all classes of engines. The following quotations will serve to show some of the practical results obtained by adjusting the lead so as to secure that which is best for the running cut-off.

J. E. Sague, Mechanical Engineer of the Schenectady Locomotive Works: "We favor reduced lead for high speed work, believing that the ordinary setting gives excessive compression, especially with short eccentric rods. Most of our recent passenger engines have 6-in. valve travel and 1 $\frac{1}{8}$-in. outside lap. With these proportions (and a plain valve ¼-in. lead at 6-in. cut-off seems to give very satisfactory results."

The full gear setting used is 1 $\frac{1}{16}$ in. positive lead in forward motion, and the back-up lead sufficiently negative to secure ¼ in. positive lead for 6-in. cut-off in forward motion. The longer the outside lap, the greater the lead may be, and the wider the maximum port opening, as will be shown farther on under the head of theoretical discussion.

Tracy Lyon, Master Mechanic of the Chicago Great Western Railway: "Lead is not needed for a cushion for the reciprocating parts; on the contrary such a lead in the running cut-off as is usually used gives such a compression that the reciprocating parts receive an enormous and unnecessary shock at the end of the stroke. I believe that the result (of reduced mid-gear lead) will be a decrease in the running repairs."

New York, New Haven & Hartford Railroad: "The valves of 20 20×24-in. passenger locomotives are set with $\frac{1}{16}$-in. positive lead at full stroke in forward motion and ¼-in. negative lead in back motion, at full stroke. We are getting the most satisfactory results from these engines of any on the road. They have attained a speed of 65 miles an hour, with eight cars, for quite a distance. The engines have been tried by setting the valves the same in back motion as in forward, but we did not get as good results as we do with the lap in back motion and $\frac{1}{16}$ in. permanent lead for the forward motion.

Amos Pilsbury, Superintendent of Motive Power of the Maine Central Railroad: "We have for the past year been experimenting with the valves of our passenger engines by giving ¼-in. negative lead in back motion. With the valves set line and line in full gear ahead, giving from $\frac{3}{16}$-in. to $\frac{5}{16}$-in. lead with a 6-in. cut-off, the advantages we find are better distribution of the steam, an improvement in steaming, a reduction of the number of hot pins and driving boxes, longer life of rod and driver brasses, and a much better riding engine. We began by gradually reducing the full gear back-up lead, noting the effect until we got back to ¼-in. negative lead. We have done this only on our passenger engines. We have for the past 10 years given no engine any positive lead and have had good working engines by leaving it off. From our experience so far am satisfied we are improving our engines by the above practice."

All the C., B. & Q. engines in through passenger service between Chicago and Burlington have their lead for 6-in. cut-off reduced to $\frac{2}{10}$ in. With $\frac{1}{16}$-in. positive lead in full gear, front and back, the valves would have nearly $\frac{3}{16}$-in. lead at 9-in. cut off. Among these engines are two which handle the fast mail, a six-car train of 60-ft. mail cars heavily loaded, scheduled at a speed of 50 miles an hour for 163 miles, this distance including six stops and two slow-downs for bridges. All these engines ride very smoothly, even at very high speeds, and do their work easily.

Mr. W. H. Lewis, Master Mechanic of the Chicago, Burlington & Northern:

"It has been our practice for the past three years to set the back-motion eccentrics $\frac{3}{16}$-in. blind, which, in our judgment, makes the engine ride more smoothly, with less strain on the connecting rods and consequently less wear of parts."

The Chicago & Northwestern Railway has experimented with and investigated the subject of reduced lead more extensively than any road I know of, unless it is the Missouri lines of the C., B. & Q. A reduced lead of from $\frac{3}{16}$ in. to ¼ in. is their standard setting for 6-in. cut-off on different types of engines. Under date of Dec. 21, 1896, Mr E. M. Herr, then Assistant Superintendent of Motive Power, writes as follows: "I have received testimonials from a large number of engines which are running on different divisions with reduced lead, and in every case, except one where the reduction was excessive, the performance of the engines has been improved, both as to riding qualities, speed and freedom from hot bearings, and in nearly every case an improvement is also shown in fuel economy." This is approved by Mr. Quayle, Superintendent of Motive Power.

J. S. Chambers, Division Master Mechanic of the Illinois Central at Paducah, Ky., writes:

"I have been setting the valves of our passenger engines with $\frac{1}{32}$-in. lead in full forward motion, and negative lead in back motion, such that the engine would have about $\frac{3}{16}$-in. lead in the running cut-off. This I vary slightly for different classes of engines. I find that the decreased lead effects the engines very favorably; they ride much more smoothly, run faster, have less hot bearings, and show an increased fuel economy of about 10 per cent. My tests have been confined to actual service. Some few have been made in comparison with engines having the standard setting, and in every case I find engines with the decreased lead have given better service all round. After three or four years' experience with a reduced lead I do not care to return to the standard setting."

J. F. Deems, Division Master Mechanic, Chicago, Burling & Quincy, Ottumwa, Iowa;

"I have believed for a good many years that most locomotives had too much lead. One of the best illustrations I have found was our engine on the fast mail. With the standard lead (which gave about $\frac{5}{8}$-in. lead at 6 in. cut-off) we had much trouble with hot driving boxes and pins, and were almost unable to make the time, even without counting these delays. We found when we reduced the lead in the running cut-off to a scant $\frac{1}{32}$-in. the annoyance of hot bearings disappeared, and we were able to make up time."

J. P. Reardon, Division Master Mechanic of the Burlington & Missouri River Railroad: "I first tried reduced lead on a consolidation engine having 50-in. drivers. During the 10 months it has run we have had no trouble with hot pins or driving journal bearings, an unusual record with engines of this class. I would also say that its coal record is considerably better than that of the other engines of the same class on the same runs. I have also experimented with several Class A four-wheel connected engines in passenger service. Among these, engine 205 has just gone into the shop after staying out two months longer than ever before. During the time it was running with reduced lead we had trouble with hot pins, though previously we had considerable trouble with the main pins. I am not ready to say that this all came about on account of the reduced lead, but I must say the engine has made a better coal record and has run a great deal smoother than ever before."

The Lake Shore & Michigan Southern has recently put in service some new ten-wheel passenger engines which have their valves set with $\frac{1}{16}$-in. negative lead in full forward gear, and $\frac{3}{64}$ in. negative lead in full back gear making the lead for 6-in. cut-off forward motion about $\frac{5}{16}$ in. Writing of them, G. W. Stevens, S. M. P., says: "While we have no tabulated figures for comparing these engines with others, the consensus of opinion from observation is that the negative lead is a positive benefit to the extent of a smoother working engine and not detrimental to the work performed."

Adjustment for Full Gear.—The full-gear lead may be set in one of three ways: First, it may be made the same for both forward and back motion; second, it may be greater in forward than in back motion; third, it may be less in forward than in back motion. Careful experiments with full-size valve gear models, plotting the results enlarged eight times, shows that with a given valve gear the steam distribution for 6-in. cut-off is the same so long as the lead for that cut-off remains the same, no matter in which way the full-gear lead is set. There will, however, be an appreciable difference

* Presented at the January meetng of the Western Railway Club by C. H. Quereau, General Foreman M. P., Burlington & Missouri River Railroad.

in the position of the reverse lever for any short cut-off. If the full-gear lead be set in the second way, the reverse lever must be moved forward of the position which it had when the lead was set for the first plan, in order to get the same cut-off. On the other hand, if the full-gear lead is set according to the third plan, the reverse lever must be brought nearer to the center to obtain the cut-off. This may seem to be a needless detail, but it should be borne in mind that the prejudices of enginemen are important factors in determining the success or failure of any detail of which they are not familiar. An engineer once lost 40 minutest because the cut off for the notch where he usually worked the engine had been reduced from 6 in. to 4½ in. by changing the full-gear setting from the first to the second method. Naturally both he and his master mechanic were not favorably impressed with the innovation. For this reason it is advisable to lengthen the reach rod, or advise the engineer what to expect when the second setting is used.

For reasons already given, it is better to make the full-gear lead for forward motion either line or line or slightly negative. In my opinion it should never be more than $\frac{1}{16}$ in. positive for a plain valve, or $\frac{1}{32}$ in. positive for an Allen valve, and less than these amounts will increase the power of the engine. When the proportions of the valve gear are such as to allow the correct lead for the running cut-off, and at the same time secure a full lead-gear lead not greater than $\frac{1}{16}$ in. positive or less than $\frac{1}{16}$ in. negative for plain valves, nor greater than $\frac{1}{32}$ in. positive or less than $\frac{3}{32}$ in. negative for Allen valves, I would prefer to make the full-gear lead the same in both front and back gear. This is of special importance when the engines must work as much in back as forward motion. Except for the effect on the engineer, which may sometimes be important, and in comparatively rare cases where the link radius is excessively long, the third method has no special advantage, and is probably objectionable because it reduces the port opening for cut-offs longer than 6 in. more than is desirable, particularly for use on such engines as must start and get their trains quickly up to speed at short intervals. Where the radius of the links is less than about 50 in., and the engines do most of their work in forward motion, the second method is probably the best.

Best Lead for Running Cut-Off.—It is apparent that the best lead will vary with varying proportions of valve gear, plain and Allen valves, long and short ports, different cylinders and clearances. With plain valves the best lead for 6-in. cut-off will usually be found to be from $\frac{3}{16}$ in. to ¼ in., and with Allen valves from $\frac{3}{32}$ in. to $\frac{7}{32}$ in. On the Chicago & Northwestern some of the latest through express engines having 20-in. ports and Allen valves "are running very successfully with ⅛-in. lead at 6-in. cut-off," though the standard lead for these engines is $\frac{5}{32}$ in. at this cut-off.

FREIGHT ENGINES.

Full Gear.—As freight engines use the full-gear and long cut-offs much more than passenger engines, it is much more important that their full-gear lead be not large, either positive or negative. I would say that it should be not more than line and line, nor less than $\frac{1}{16}$-in. negative, for forward motion. Herr von Borries says: "In the case of a number of locomotives built in England from my designs, having Stevenson valve gear, have preferred to set the eccentrics with equal angles of advance, and the valves line and line in full gear. This valve gear was criticized considerably by the builders, but proved very efficient."

Running Cut-Off.—Because of the slow piston speed and wide port opening, a negative lead will give better results than positive lead when a locomotive is working at full stroke. This is true because there is abundance of time in which to get full pressure in the cylinder, and preadmission of steam acts only to block the piston and lessen the power of the engine. At high speeds and short cut-offs the case is entirely different. Not only is the port opening but a third of that at full gear, but the length of time it is open decreases considerably faster than the speed increases. Taking these facts into consideration, and remembering that the lead is about 85 per cent. of the maximum port opening at 6-in. cut-off it is apparent that the lead should increase as the cut-off is shortened for increasing speeds. It follows that, when freight engines have the same diameter of the drivers as the pa engines, the lead for the former should be less than for the latter in proportion to their lesser speed, and that the lead for small drivers should be somewhat greater than for large, if both make the same time. The point I would specially emphasize is, that the lead of freight engines should be as carefully set as for those in passenger service. Quoting again from Mr. Deems: "We had a freight engine that was giving a great deal of trouble on account of hot bearings (not engine truck or tank bearings), and the annoyance disappeared immediately on reducing the lead. We think reduced lead helps all our freight engines." Quoting from Mr. Chambers: "I find the result of reduced lead on freight engines has been fully as effective as in passenger service."

At the last meeting of the American Railway Master Mechanics' Association Mr. Herr cited the case of a freight engine, the power of which on a long heavy grade was increased 10 per cent. by properly reducing the lead.

As both theoretical and practical experience shows that road engines are more powerful where they have negative lead in full gear, it follows that switch and helper engines should have their full gear lead not greater than line and line, and preferably it should be slightly negative.

SUMMARY OF EXPERIENCE.

It would seem to be demonstrated by the evidence submitted that a correct adjustment of the lead, especially for the running cut-off, is an important matter; that such an adjustment makes a much smoother riding engine than the usual setting, reduces internal friction and lessens running repairs as shown by the record of hot pins and driving wheel journals, and increases the power of an engine as demonstrated by the numerous cases where the capacity for speed has been increased. A quite general saving in fuel is also reported. That this should not be apparent in every case is not at all remarkable, and in no way discredits the results obtained by those who make the claim. For usually the greater the power which can be developed, the greater the demand for speed, and the greater the speed the poorer the fuel record. It is worth special notice that in almost all cases the statement is made that the engines with reduced lead have been tried in comparison with those having the standard setting. Nor should it be forgotten that a correct lead is as important for freight as passenger engines.

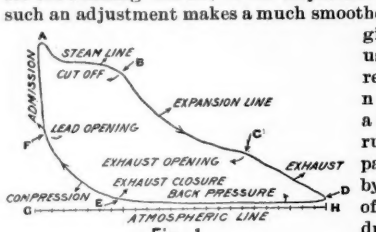


Fig. 1.

THEORETICAL DISCUSSION.

Excessive Lead Produces Excessive Compression.—If exhaust closure takes place at half stroke, with 3 lbs. back pressure and 8 per cent. cylinder clearance, the pressure at the end of the stroke will reach only 113 lbs. If compression begins at 15 in., with 12 lbs. back pressure, the highest pressure reached at the end of the stroke will be 137 lbs. With a cut-off of 6 in. and a valve line and line inside, compression begins at about 15 in. of the return stroke with the usual locomotive valve gears. It is therefore evident that, with a 6-in. cut-off, the pressure in the cylinder due to true compression will scarcely equal any boiler pressure commonly used, and we must look elsewhere for the cause of the excessive compression so commonly found on high-speed locomotives. By "excessive compression" is meant compression above boiler pressure which takes the form of a loop at the end of the indicator card. This cause I believe to be excessive lead. An examination of Fig. 2 will show this conclusion to be warranted. These cards were all taken from the same engine, under practically the same conditions, except a difference in lead. If the conclusion that excessive compression is due to excessive lead be admitted, it follows that any reasonable amount of inside clearance will not remedy the trouble, and that the lead should be correctly set before inside clearance is given.

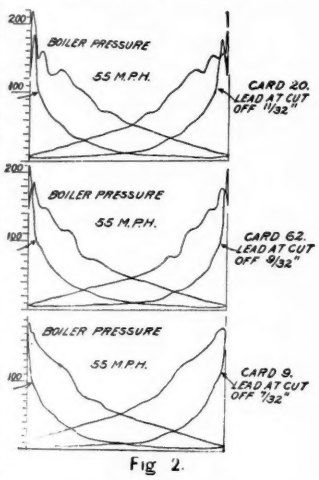


Fig 2.

A Reduction of Excessive Lead Increases Power.—There are doubtless some who, though convinced by the weight of the experience cited that a correct setting of the lead is of considerable importance, and that a reduction of the lead may actually increase the power of an engine, yet do not understand how this can be true. Their argument is as follows: "The lead for the running cut-off is usually from 80 to 90 per cent. of the maximum opening; a reduction of the lead therefore reduced the port opening and consequently reduces the amount of steam admitted to the cylinder; a reduction of the lead must therefore reduce the power of the engine." The following may help to explain the fallacy of this argument, and may show why a reduction of lead gives the results obtained by experience in service.

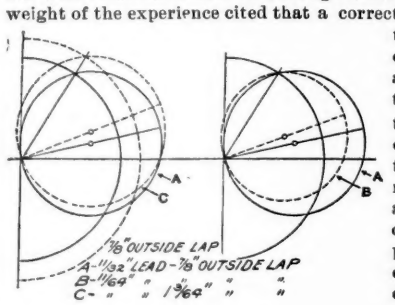


Fig. 3.

In Fig. 3 the Zeuner valve diagrams were drawn, making due allowance for the angularity of the main rod and for the distance from the center line of the cylinder to the center line of the driving axle on our Class H mogul locomotives. Fig. 4 has been constructed from the data furnished by Fig. 3. In Fig. 4 the base line represents the travel of the crank if its circular path be extended in a straight line; the upper horizontal line shows the position of the piston corresponding to given positions of the crank; and the distance from the base line to the curves shows the port opening with the different valve settings for any position of the crank or piston from lead opening to cut-off. Inasmuch as the crank travels at a uniform speed so long as the speed of the engine remains the same, the figures on the base line may stand for equal intervals of time as well as distance. Assuming a constant steam-chest pressure and uniform speed for the drivers, it is evident that the steam pressure in the cylinders for any given period of the stroke shown in the diagram depends both on the port opening and the length of time it is open. In short, the influence of the various valve settings is represented by the area inclosed between the base line and the curves. For convenience the shaded portion at the right of the dead center line will be designated as the "steam line area."

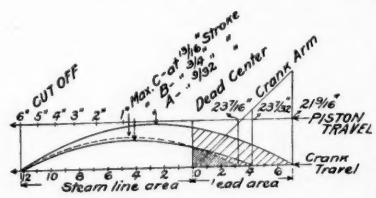


Fig. 4.

From Fig. 3 the following tables are derived, using a planimeter to obtain the areas:

TABLE 1.

	Setting A, in.	Setting B, in.	Decreased, per cent.
Lead	11-32	11-64	50.0
Lead area	2.90	.82	71.7
Area first 3 in. of stroke	5.70	3.76	34.0
Area second 3 in. of stroke	1.00	.76	24.0
Total steam line area	6.70	4.52	32.5

Beyond a certain amount necessary to fill the clearance space, the effect of preadmission is to reduce the power of the engine, both by reducing the area of the card at the compression end, and by increasing the internal engine friction. A study of Table 1 will show that a reduction of 50 per cent. in the lead, secured by adjusting the eccentrics, reduces the lead area 72 per cent. and hence reduces the harmful effect of readmission by at least as great an amount. It will also show that a reduction of the lead by 50 per cent. will reduce the steam line area only 32.5 per cent. But more important is the farther fact, that during the first 3 in. of the stroke, when the piston travels comparatively slowly and therefore differences in port opening have least effect, the steam line area is reduced 34 per cent.; while during the second 3 in., when differences in port opening are most efficient because of the higher piston speed and narrower port opening, a 50 per cent. reduction of the lead reduced the steam line area only 24 per cent. In other words, a reduction of excessive lead increases the power of the engine, by decreasing the harmful effects of preadmission much faster than it decreases the amount of steam admitted from the dead center up to the cut-off.

TABLE 2.

	Setting B, in.	Setting C, in.	Decrease, per cent.
Lead	11-64	11-64	.0
Lead area	.82	.61	25.06
			Increase, per cent.
Area first 3 in. of stroke	3.76	4.10	9.0
Area second 3 in. of stroke	.76	.86	13.2
Total steam line area	4.52	4.96	9.7

Table 2 shows that, where the circumstance will allow, it is better to reduce the lead by increasing the outside lap of the valve than by adjusting the position of the eccentrics. Because, by securing the end sought by means of the lap, the lead area is reduced more, and the steam line area less, than though the eccentrics were moved to reduce the lead.

There is evidently a point beyond which a decrease in lead will decrease the power, because the lead will not be sufficient to properly fill the clearances and the port opening will be reduced so as not to admit sufficient steam to fill the cylinder to the desired pressure. The correct lead, which will give the greatest power, cannot be determined by theory or argument, but must be settled by means of the indicator and practical experience. In general terms it may be said to be the largest which can be given consistent with a full smooth compression line, without a loop at the top, when determined by the indicator. In this connection it should be remembered that the long indicator pipes which must be used with locomotives when indicated on the road, will give a card on which the compression line shows no objectionable features; but when the indicator is coupled directly to the cylinder, the same valve setting will show a small amount of objectionable compression—*i. e.*, an abrupt bend at the point of lead opening and a loop. This action of the long pipe has been well shown by Professor Goss of Purdue University. When the indicator cannot be used, the best lead can be quite closely approximated by decreasing it, a little at a time, so long as the engine rides with a perceptible vibration at high speeds. For this method it is assumed that the wedges are properly adjusted and the engine rides smoothly when the throttle is closed.

Effect of Reduced Lead on Steam Distribution.—A reduction of the midgear lead from $\frac{3}{8}$ in. to $\frac{7}{32}$ in. delays the point of exhaust opening ¾ in. and also

delays exhaust closure 1/16 in. In other words, it lengthens the period of expansion and delays compression. Or, put a little differently, it has the same effect on release as inside lap, and on compression as inside clearance would have. This, taken in connection with the fact that it reduces internal friction, will readily account for the saving in fuel reported. Herr Von Borries expresses the matter as follows: "That the port opening is somewhat decreased is of minor importance; but that the expansion is increased about three per cent. of the stroke, and the exhaust closure is delayed about four per cent., and compression thereby reduced, that the reduced lead greatly reduces the internal friction, are matters of decided advantage."

Allen Valves.—The use of an Allen valve will allow a reduction of the lead. In fact it will necessitate such a reduction if the best results are to be obtained. Assume that with the introduction of the Allen port the lead should be reduced from 1/4 in. to 5/32 in. The following table is taken from a Zeuner valve diagram of a gear having 7/8-in. outside lap, 1/4-in. inside clearance, 48 3/8-in. link radius, 5-in. travel in full gear, and is for 6-in. cut-off.

	Plain valve.	Allen valve.
Lead	1/4 in.	5/32 in.
Lead opens at	22 7/8 "	23 1/2 "
Maximum port opening	39-100 "	24.100 in. + 12-100 " = 36.100 in.
Release begins at	13 1/4 "	13 7/4 "
Compression begins at	18	18 3/4 "

Assuming that the Allen port is half as efficient as the port opening at the end of the valve, the use of the Allen valve with the accompanying reduction of the lead has increased the port opening 20 per cent., delayed lead opening 5/8 in., exhaust opening 3/4 in., producing the same effect on release as reducing the inside clearance from 1/4 in. to 5/32 in., and delayed the beginning of compression 3/4 in., having the same effect on compression as increasing the inside clearance from 1/4 in. to 5/16 in. There can be no doubt this change will appreciably increase the power of the engine except for very slow speeds, and probably will favorably effect its economy. If the Allen valve is an advantage for passenger engines, I see no reason why it should not be equally so for freight service, especially in these days of fast freights.

CONCLUSIONS.

Both the extensive practical experience of a number of careful men with four-wheel connected, mogul, 10-wheel and consolidation engines on a large number of the most important roads in the United States, and theoretical considerations, have shown that a correct and accurate setting of the lead is a very important matter; that such a setting favorably affects the power, speed, running repairs and fuel record for locomotives in both freight and passenger service; that to secure the best results it is generally necessary to reduce the lead commonly used that the general plan of specifying the full-gear lead without reference to the lead produced in the running cut-off is bad practice.

It is the opinion of the writer, which could be substantiated by experience of the paper submitted, that the use of the Allen valve is desirable, both for freight and passenger engines.

Effects of a Sleet Storm on Electric Elevated Roads.

On the afternoon and evening of Tuesday, March 2, there was a heavy storm of sleet and rain at Chicago, which lasted nearly six hours. The storm began about three o'clock in the afternoon, and as the temperature was about at the freezing point everything was shortly covered with a sheet of ice.

From the reports in the daily papers it would appear that trains on the elevated and street railroads were greatly delayed, especially on the electric elevated roads using the third rail. We have obtained direct information from reliable sources regarding the delays which occurred, and their causes, on those roads reported to have been most seriously affected. It is interesting to know that the reports were exaggerated and that in some instances there was no foundation for the statements made.

On the "Alley L," where steam locomotives are used, there was no trouble, except that slippery rails made starting and stopping difficult, and trains were run on schedule time.

The surface roads, using the cable and the overhead trolley, had little trouble to keep the tracks clear of ice. These roads have had such long experience with Chicago storms that they are now well equipped with machinery for clearing the tracks, and as soon as a storm commences these machines are put in service.

The Metropolitan West Side Elevated, which uses a third rail for carrying the electric current, suffered no delays until about seven o'clock in the evening, by which time the heavy traffic was over; then trains were delayed 20 minutes. This delay was caused by one motorman, who, having had no previous experience in such weather, was unable to start his train from a station on account of the ice on the third rail. An inspector was sent out with him after this delay and there was no further trouble. Most of the motormen learned last winter how best to operate their trains in bad weather.

The longest delay occurred on the Lake Street Elevated, where the third-rail system is used. This is the first winter that the Lake Street road has used electricity, and, therefore, the first heavy ice storm of the season found the motormen unused to working under such conditions. The road has one car fitted with scrapers for use when the tracks are obstructed with snow and ice, and this car was used on the afternoon in question until it, with other trains going west, was blocked by a train on which the drawbar pulled out between Canal and Halstead streets. The delay caused by the broken drawbar allowed the third rail to become thickly coated with ice; the train immediately following could not get sufficient contact on the trolley rail to move both trains, and hence the road was quickly blocked, it requiring one hour and 45 minutes to get the westbound trains moving again. This was finally accomplished by running a steam locomotive from Forty-first street east on the westbound track, thus breaking the ice and cleaning the third rail, on which ice had formed at least 1/4 in. thick. If the drawbar had not broken, thus rendering useless the car equipped for clearing the track, there would undoubtedly have been no more delay than that caused by slippery rails, which make starting and stopping difficult.

It is evident from the experience gained during this storm that so long as nothing happens to make a first delay and thus permit a thick coating of ice to form, the third-rail system works satisfactorily even in very bad weather, and that a slight covering of ice is broken by the trolley shoe. The unusual amount of arcing and sparking which occurs under these conditions does no damage either to the contact shoes or to the rails.

One reason why delays sometimes occur on the Chicago electric elevated roads during hard sleet storms is that such conditions have been so rare in the past that officers and men have had little chance to test the working of their devices for clearing the tracks, and occasional delays are to be expected. Those due to this storm cannot fairly be taken as an argument against the third-rail system for elevated roads, for as soon as it is known what failures are most liable to occur at such times measures can be taken to effectually guard against similar troubles in the future.

Some Signal Problems.*

BY H. M. SPERRY, SIGNAL ENGINEER.

Great strides have been made in the United States toward uniformity in practice in railroad signaling. The American Railway Association has formulated a standard code for block signaling and is now preparing one for interlocking, and it is safe to predict that within the next five years the practice in signaling will be nearly uniform. It is also believed that there will be a great increase in the installation of block signaling and interlocking, in order to keep pace with the demand for faster trains and to insure a greater measure of safety for them. It is well to consider at this time some of the signal problems that have not yet been satisfactorily solved

The most prominent one is that of the colors for night signals. To-day, red is universally used for the danger or stop indication; white, with some few exceptions, for the clear signal, and green for the caution signal. The railways of Great Britain have decided that this is not satisfactory, and in spite of the heavy expense involved on account of the large number of signals, they have substituted green for their clear signal. As they have always used red for their distant signal, this involved no complication, as their almost universal use of absolute block signals made it unnecessary to provide a caution signal for permissive blocking. The conditions here are somewhat different; red has never been used as a color for the distant signal, and the general use of permissive blocking requires a caution signal for this purpose. Our problem, therefore, is to find a color or combination of colors for the caution signal, so that we may use green for the clear signal. It is pretty generally conceded that this must be done, there being a feeling that our present method of depending upon the indestructibility of a piece of red glass is wrong. It has led to accidents and will lead to more, the danger increasing with the increase in the number of signals.

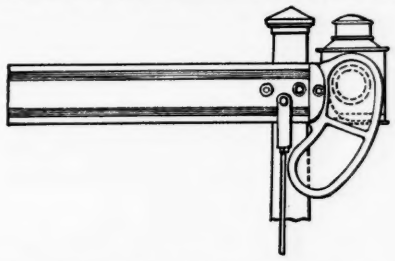


Fig. 1.—London & North Western Standard Semaphore.

There are two things that can be done: protect the red glass or find an efficient third color. The protection of the glass by means of a wire netting has been tried with some success; substitutes for glass have been investigated, but the net result is, that even if we protect the glass, we still might have a breakage of the semaphore casting, and cases are on record of castings breaking off, leaving the white light in the lamp exposed to view. Attempts in this direction would therefore seem to be comparatively useless, and we must now look for another color or combination of colors. No end of experiments have been made with the result that no satisfactory third color for night signaling has been discovered. This leaves us to consider a combination of colors, and a most successful attempt in this direction is that used on the Chicago & Northwestern, *i. e.*, red and green, the green being a reflected light by means of a special lamp. This is used for distant signals on the C. & N. W. For interlocking signals, the problem therefore seems to be solved: red for danger or stop, green for safety or clear and red and green for the caution indication of distant signals.

We have, however, only solved a portion of the problem. What shall we use for the caution signal for permissive blocking? Can we make a satisfactory block signal that will show red for stop, red and green for caution, and green for clear? When this is done we shall be able to present a complete scheme for night signaling that will be as nearly perfect as is possible, and I believe that it will then be found that the question of expense in changing our present system will assume less importance. The sooner the change is made the better, and in fact all signals that are to be erected should be arranged for this new system of lights. A few roads are using more than one lamp for their signaling, illuminated arms, etc., but they are the exception.

The next question of importance is the use of derails and the distance that they should be located from their danger points. The serious accident of last year at a point not protected with derails calls our attention very forcibly to this subject. Derails are more extensively used in the West than in the East, although in the East trains are more frequent and run at a higher rate of speed. Have we overdone the matter in the West or do they need more derails in the East?

Derails suggest the question of electric locking, and great credit should be given to some of our Western lines that have pushed this matter to the front. The number of successful applications of electric locking, entirely removing the danger of changing a signal and derailing the train, after a train has once accepted it, is ample testimony as to the efficiency of the device, and the number of mistakes that have been made through an improper changing of signals clearly shows the necessity of electric locking.

A distant signal to be effective must be located at such a distance from the home as will enable a train to stop at the home signal, if when passing the distant signal it is found to be in the caution position. Twelve hundred feet is not enough; 1,500 ft., as used on some lines is better, and if trains are to be run at high rates of speed, 2,000 ft., a distance used on many lines in the East, would be better yet. The distance, however, should be determined by the local conditions, and, in fact, in some cases, no distant signals whatever are necessary, as it is certainly bad practice to erect distant signals that are never used.

Distant signals not in sight from the tower should be provided with electric repeaters.

Some method of checking the operation of distant signals is desirable, so that carelessness in their operation by allowing them to stand constantly at danger can be guarded against.

The semaphore is our standard block signal and is rapidly replacing all other forms. There are three different methods of giving block signal indications, the almost universal practice being horizontal for the stop position, inclined to an angle of 45 deg. below the horizontal for caution, and the arm hanging almost vertical for clear. A feeling that the difference between the caution and clear indication was not enough led to a design in which the clear indication is given by the absolutely vertical position, the arm being so centered as to stand clear of the post; another gives the caution indication by raising the arm of an angle to 45 deg. *above* the horizontal. To operate the signal for these three positions, the lever stands normally at the middle of its full stroke and is moved from its middle position in one direction for caution and in the opposite for safety. This feature makes an unsatisfactory arrangement for use in an interlocking machine, and some one has suggested a change in the danger or stop position, *i. e.*, to use the the position of 45 deg. *above* the horizontal for stop, horizontal for caution, and 45 deg. *below* for clear. This would be a radical change, with the only advantage that the three positions could be operated by an interlocking machine. It would be just the reverse of the German practice, which is horizontal for stop, and above the horizontal for clear, and the Germans undoubtedly displayed very good judgment, as an accumulation of snow and ice on the arm in the clear position would only tend to force it to the stop position. The Germans use red for danger and green for clear.

I believe that the best permissive signal is to use a second arm with both arms horizontal for the danger indication, one arm dropped for caution and both arms dropped for clear. [Described in the *Railroad Gazette*, Dec. 11, 1896.]

Separate train order signals at interlocking plants and at points where there are block signals, is a confusing arrangement, the engineman being required to look not only for the train order signal, but for the *others*, and as these train order signals are not interlocked with the interlocking or block signals, it is possible to find the train order signals at danger and the others at clear, and *vice versa*. That this will lead to accident there can be no possible doubt. Either dispense with the train order signals or else interlock them.

The next question is an improvement in our semaphore castings. At present the colored glasses are practically the same size as the lenses in the lamps, therefore any slight dropping of the arm would tend to show a portion of the white light. This can be overcome by using glasses somewhat oblong in form, thus providing for a certain amount of lost motion before the lens of the lamp is uncovered. The attached sketch and description of signal, used on the London & Northwestern Railway of England, illustrates this very clearly.

The substitution of metal posts for wooden ones is a step in the right direction, and very satisfactory posts can be had by using the same construction as that in use for supporting the wires of electric railways.

Up to the present time little attention has been paid to designing switches for interlocking, and there are one or two points that should not be overlooked in this matter. One is that the head rod of the switch should, in all cases, be 12 in. from the point in order to properly place the tie at the point of the switch between this rod and the lock of the interlocking. In order to provide for lost motion, switches should be connected by means of a screw rod passing through a lug on the switch rod and by providing 1 in. more stroke than is necessary to operate the switch, lost motion can be taken up from time to time by simply screwing up the nuts of the screw rod. This is an improvement over the method of connecting direct from crank to the switch with the same stroke on the crank as there is on the switch, thus necessitating a change in the stroke of the crank whenever necessary to take up lost motion.

Slip switches, for the reason that they take up less room than cross-overs, are especially desirable for yards or other places where space is limited, but as they are much more complicated than ordinary cross-overs, they should be avoided as far as possible.

Rail braces especially designed for interlocking, so that they can be placed under detector bars, are a necessity, and on a road with very much interlocking, a standard rail brace that could be used either under detector bars or elsewhere would be better, I believe, than two styles of braces.

The weak point of facing point locks or switch and lock movements is usually a question of maintenance. Unless switches are properly kept to gage by means of tie plates, substantial rail braces used and the plungers left blunt, with sufficient stroke, locks are sure to fail. It is certainly an easy matter to maintain these locks in their proper condition, and as so much depends upon them, this should be insisted upon. In this, however, the interlocking department must have the hearty cooperation of the track department. A few standard rules on this subject would be very desirable.

Bolt locks should be used not only with switch and

*Paper read before the Railway Signaling Club, Chicago, March 9.

lock movements, but with facing point locks. The connections in all cases should lead directly through the bolt lock to the signal.

Selectors are not being used to the extent that they were at one time, and it is gratifying to note this, as they were only brought forward as an economical device. In no case should they be used for converging routes, as this means that conflicting signals are operated by the same lever, and a failure on the part of the selector or connections might lead to a wrong signal.

While wire is almost universally used for operating signals, there is a feeling that pipe is better. Pipe adds considerably to the cost of an interlocking plant, and I believe that we can do no better work than to appoint a committee to thoroughly investigate this subject.

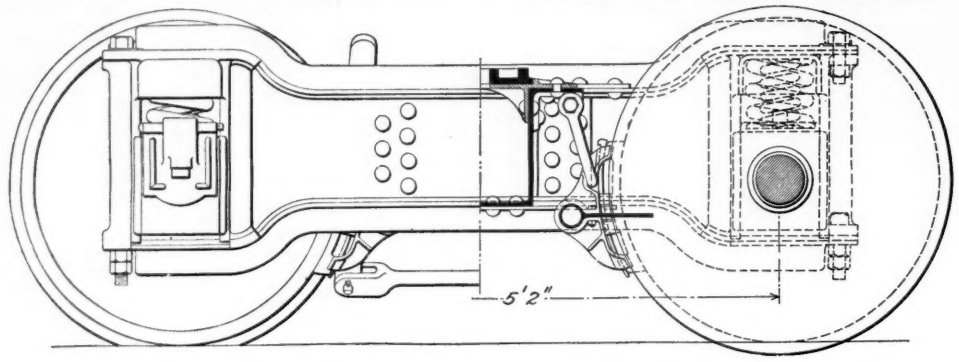


Fig. 1.—Half Side Elevation.

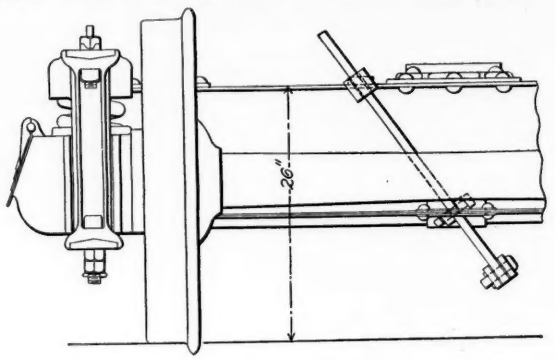


Fig. 4.—End View.

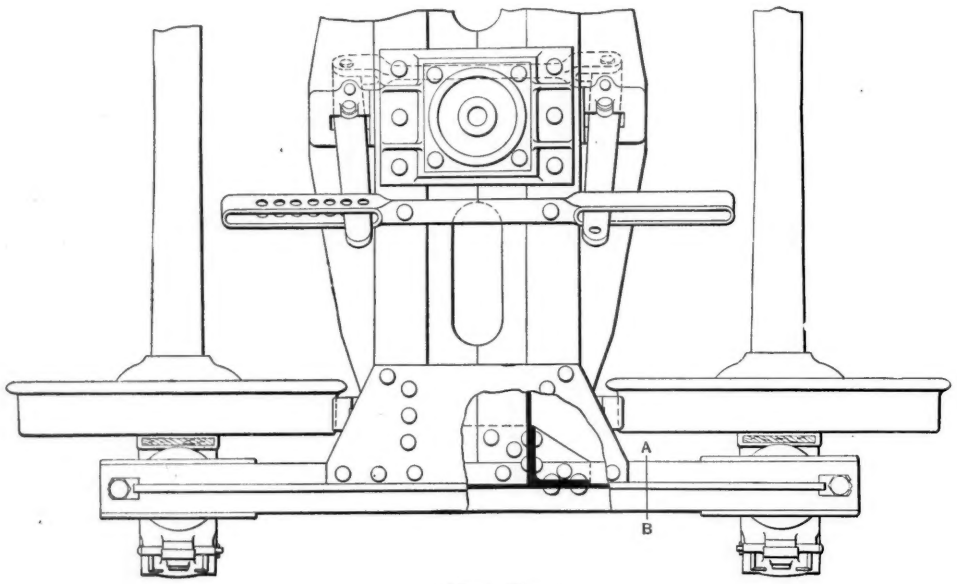


Fig 2.—Plan.

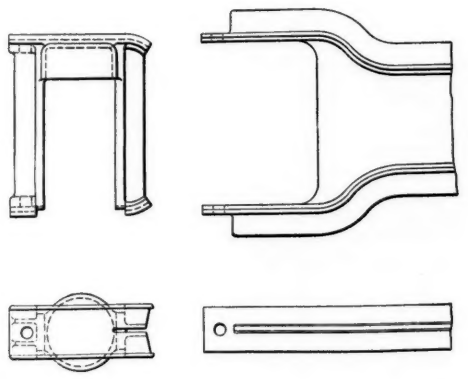


Fig. 6.—Pedestal Arrangement.

The Hewitt Rolled Steel Truck.

Some modifications in the general arrangements of levers in the machine have lately been brought forward and proved very satisfactory, particularly in large plants, considerable saving in the labor of operating has resulted by grouping the levers, *i. e.*, placing the signal levers as closely as possible to their respective switches, instead of putting them at the ends as was the former practice.

Towers are now being built with the window sills of the operating floor not over 18 in. above the floor, in order to get a better view of the tracks. An overhanging roof is a desirable feature as it keeps out the strong glare of the sun, thus dispensing with the use of window curtains, or awnings.

The signal adopted by Mr. Webb (shown in the cut) is of the ordinary semaphore type, the poles being of pitch pine timber, varying in size from 9 in. × 9 in. to 15 in. × 15 in. at the bottom, according to the height of the post, to 6 in. × 6 in. at the top, upon which is placed a galvanized iron cap. The bottom part of the post for about 7 ft. is left the full size of the timber from which it is cut, and thus, at the "wind and water," or ground level, where the process of decay is most rapid, 10 in. or more timber is left, which, after being charred, is well coated with gas tar. The signal arm is formed of a thin steel plate, stiffened by two corrugations running lengthways of the arm; this is riveted to a galvanized cast-iron center upon which is fixed an adjustable frame for the spectacle glasses, made sufficiently heavy to counterbalance any accumulation of snow on the arm and to keep it in its danger position should any of the fittings fail. The arm works on a spindle squared to receive it at one end, and the back light lever at the other, and the spindle turns in a casting fastened to the post by four ⅝ in. bolts, which also serve to secure the lamp bracket placed at the back of the arm; this is of sufficient width to form a stop for the arm when in danger position.

The Hewitt Rolled Steel Truck.

The Hewitt Manufacturing Co., Chicago, is now putting on the market a new metal truck, patented by Mr. H. H. Hewitt, for use under locomotive tenders and freight cars, being especially designed for cars of 100,000 lbs. capacity. The object has been to produce a truck of simple construction which could easily be repaired, and especial attention has been given to the proper placing of material.

The accompanying illustrations show the Hewitt truck as built with a rigid bolster, Figs. 1 to 4 inclusive being views of truck as a whole, while Figs. 5 and 6 are special details.

It will be seen that the side frames consist of rolled steel shapes of a section as given in Fig. 5. This section is made by the Carnegie Steel Company especially for the Hewitt Manufacturing Company, and in addition to being a strong form in proportion to its weight, the flanges are easy to connect to, and the construction is therefore simplified. The material for the frames when received is straight and is afterward cut out and shaped at the ends to make room for the pedestals.

The pedestal used is made of malleable iron, and as shown in Fig. 6, is placed in the opening at the end of the frame, being held at the top and bottom by wings cast on the pedestal, which come outside the flanges of the frame; also the pedestal has a slot into which fits the web of the side frame. The pedestal is prevented from slipping backward by two bolts joining it to the upper and lower journal flanges of the frame. The advantage in this construction is that by placing jacks under the side frames to carry the weight of the car and taking out the two pedestal bolts the wheels can be removed and replaced without special tools, avoiding raising the car or removing the trucks from under the car.

The journal box conforms to the dimensions of the M. C. B. standard, and double-coil springs are placed above the box; these are held in place by a lug on the box and by the spring cap cast on the pedestal.

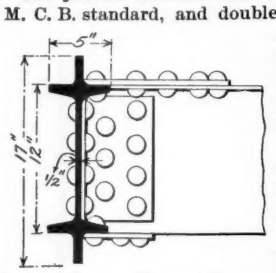


Fig. 5.—Section Through Frame at A B.

The transom of the truck shown is built up of 2½-in. × 5 in. × 5 in. × 12 in.-Z-bars joined to the side frames by top and bottom cover plates, which are riveted to the flanges of both the Z-bars and frames; corner angle are used to connect the webs. The center plate is made of iron of a form as shown in Fig. 3, and is riveted to both the flanges and webs of the Z-bar forming the transom. The transom and side frames form together a very rigid and simple construction.

A Traveling Plant for Treating Ties With Woodiline.

The American Wood Preserving Company, which controls the process for timber preservation by treatment with Woodiline, has recently been called on to design a traveling plant for a Western road. It was desirable to be able to treat the ties at various points where they were collected rather than to haul them a considerable distance to a central plant. The Woodiline treatment, as must now be well known, consists simply in dipping the timber in the preservative liquid without the application of any pressure; that is, it is quite sufficient to have open tanks. Ordinarily, the timber to be treated is dipped in a hot bath of the oil, but very good results have been got by applying it to the surface, while hot, with a brush.

The locomotive treating plant which the company devised is extremely simple. Two tanks, each 10 ft. long, and a small derrick, are mounted on an ordinary flat car. These tanks are of sufficient size to take in bundle of 12 ties each; that is, they are 10 ft. × 5 ft. × 3 ft. made of ⅜-in. iron. The derrick is a simple wooden crane of about two tons' capacity, having a sweep of 9 ft., with a 12-ft. 6-in. boom. The ties are made up in bundles of 12 and are kept apart by inserting them in a cast-iron spacing frames, and by these frames they are slung up by the derrick. The steam piping for heating the liquid to about 150 degs. is a single coil of 1½-in. pipe around the bottom of each tank, steam being taken from the locomotive which hauls the car. It is estimated that a working force of six men and a foreman would be sufficient to operate this small plant.

The bundles of ties are to be left in the tank about 12 minutes and from 850 to 900 ties a day can be treated. The entire labor cost per tie is estimated at a little over one cent.

The Vice-President's Fast Run.

We have received the official record of the fast run made over the Central of New Jersey, the Philadelphia & Reading and the Baltimore & Ohio on March 2 with the special train carrying Vice-President Garret A Hobart from Jersey City to Washington. The main features of the run were given in our issue of March 5, page 174. The official time record is as follows:

				Distance. Miles.	Time. Mins.
Jersey City		11:15	a. m.	0	....
Elizabeth		11:28½	"	11.5	13½
Plainfield		11:40	"	23	25
Bound Brook		11:46	"	30.2	31
Trenton Junction	Arrived	12:15	p. m.	57.3	60
	Left	12:17	"		
Somerton		12:32½	"	71.9	77½
Jenkintown		12:39½	"	79.3	84½
Wayne Junction		12:46	"	85.1	91
24th St., Phila	Arrived	12:56	"	92.4	101
	Left	1:05	"		
Wilmington		1:31	"	117.5	136
Newark		1:43	"	.....	.....
Susquehanna Bridge.		2:01	"	.....	.....
Bay View		2:33	"	.....	.....
Lee St., Baltimore		2:47	"	189.1	212
Laurel		3:08	"	.....	.....
Washington		3:23	"	228.6	248

The time deducted for stops was 17 minutes—at Trenton Junction, 2 minutes; at Philadelphia, 9 minutes; at Susquehanna Bridge, 3 minutes and at Bay View, 3 minutes. The latter stop was for water. At the bridge the train did not stop, but 4½ minutes were consumed in crossing the bridge, which is 1¼ miles long.

The train consisted of three private cars and a baggage car, weighing altogether 372,770 lbs. One of these cars

the Atlas, of the Central of New Jersey, weighs no less than 112,000 lbs. The engine used between Jersey City and Philadelphia was No. 457, Central of New Jersey, and it was run by Engineer Alpaugh. On the Baltimore & Ohio the engine was No. 1,313, and it was run by Engineer Schultz. Both of these engines were built by the Baldwin Locomotive Works. No. 457 is a Vauclain compound of the Atlantic type. It weighs 141,000 lbs., and has 80,000 lbs. on the drivers. The cylinders are 13 in. and 22 in. × 26 in. and the drivers are 84½ in. in diameter.

No. 1,313 is a 10-wheel simple engine, Class B 14. It weighs 145,200 lbs., of which 113,000 lbs. is on the drivers. The cylinders are 21 in. × 26 in., and the diameter of the driving wheels is 78 in.

The average time between Chester and Wilmington and Wilmington and Newark was 60 miles an hour, speed being slackened through Wilmington. From Newark to the east end of the Susquehanna Bridge the average rate was 64 miles an hour. From the west end of the Susquehanna Bridge to Bay View, where a stop was made for water, the average speed was 67.5 miles per hour. In this latter distance the 8.8 miles between Cowenton and Bay View were covered in seven minutes, over 75 miles an hour. The average time between Baltimore and Washington was 66.3 miles an hour. It will be seen that the rate of speed through, 228.6 miles in 248 minutes, was 55.3 miles an hour. After making the deductions noted, it averages 59.3 miles an hour.

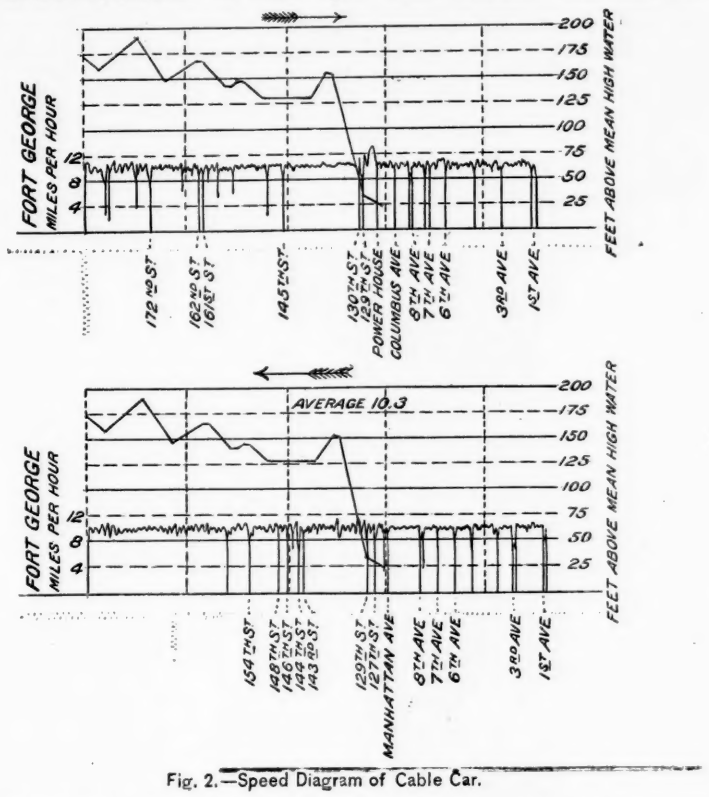


Fig. 2.—Speed Diagram of Cable Car.

Some Studies in Speed and Accelerations of Various Motors.

BY GEO. L. FOWLER.

Rapid transit has become a matter of such vital importance to the citizens of all large American cities and especially to the citizens of New York, where the urban transportation must be carried on in parallel lines for long distances from a point of maximum congestion, that it was decided to make a careful investigation of the possibilities of the several methods of transportation that are now in use, with the view of determining what they were capable of doing under the present conditions. In this investigation, as thus far conducted, attention was paid solely to the physical possibilities as exemplified by the actual conditions, of practice, without regard to commercial considerations, either when looked upon from the standpoint of the first investment, the possibilities of declaring dividends upon that investment or the expenses of operation—very important matters, to be sure, but requiring so broad a treatment and consideration as to carry them beyond the bounds of a single paper. This contribution to the available data will, therefore, be confined to a mere statement of the mechanical possibilites of the several methods of passenger transportation that are at present in use in the neighborhood of New York City.

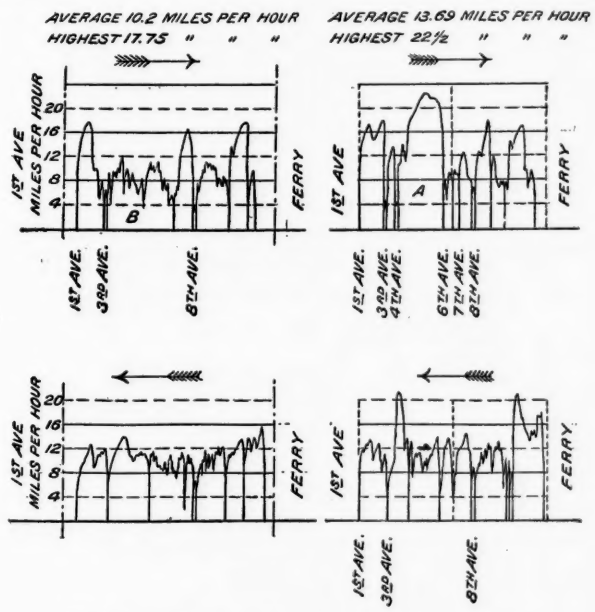


Fig. 3.—Speed Diagrams Hardie Compressed Air Motor.

Every effort was made to obtain the highest results for each type of motor, and careful inquiries were made on all hands with the intention of neglecting no opportunity. The object of giving the best results of daily practice was twofold: First, it would show the highest speeds that can be relied upon under favorable conditions, day in and day out, for each and every type of motor; second, it would block the advocates of any one particular type and prevent them from claiming that had a fair field and no favor been extended, the special motor in which they are interested would have shown a very much better record. Such extravagant and unsubstantiated claims have been made for every class of propelling power, it is so easy to claim high speeds and lightning-like acceleration, and it is so undoubtedly true that improvements bringing about higher speeds and better service along the whole line will be made, that it has been necessary to absolutely discard all speculation and confine ourselves to the bare statement and analysis of the facts as they presented themselves, merely adding one slight suggestion as to a possible improvement that could be made in the present service, but without calling for any development orchange in motive power.

In making this investigation every facility possible was extended by the officers controlling the lines on which the work was done, and it is due to their courtesy and assistance that the results given below were obtained. The instrument used was a Boyer railway speed recorder that had only been used once before, but in order that its condition might be known it was returned to the makers and calibrated. These instruments are set to have their driving pulley make 600 revolutions to the mile run, and upon calibrating this one the company reported that when running at a speed corresponding to 10, 35, 40 and 75 miles per hour, the registration of the instrument was absolutely correct; at speeds corresponding to 15, 20, 25, 30, 75, 80 and 85 miles per miles per hour the registration was .43 of one per cent. low, while at 45, 50, 55, 60 and 65 miles it was 0.42 of one per cent. high. The working of the instrument may, therefore, be considered as accurate throughout, as even when registering 65 miles per hour the variation from accuracy would be but .273 of a mile, and even this discrepancy would diminish as the speed decreased, dropping to .0645 at 15 miles.

All of the pulleys used on the axles of the motors were furnished by the Boyer Railway Speed Recorder Co., of St. Louis, and were turned with special reference to the spring belt used with the instrument. Owing to the low speeds at which it was expected that most of the motors would run, the instrument, with one exception, was driven to indicate a higher speed than that at which the motor was actually running. Thus, on the Manhat-

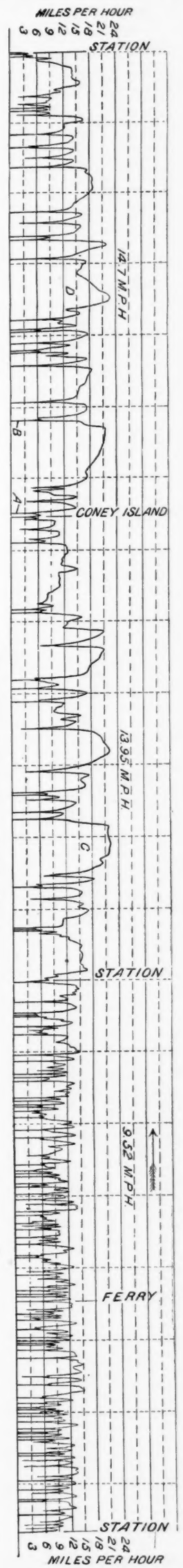


Fig. 4.—Speed Diagram Nassau Electric Railroad.

tan Elevated Railroad, for example, the instrument would have indicated a speed of four miles per hour, while the actual speed was but three, and so on in the same ratio through the whole scale. Care was taken, however, that the indicated speed should not exceed the limits of the instrument. This was done in order to enlarge the diagrams and exaggerate the variations in speed.

The time lost at stops was taken with a stop watch, whose variation from accuracy was about one-eighth of a second in four hours less probably than the personal equation of the timer.

In adjusting the instrument to the several motors, the circumferences of the two wheels on the axle were carefully measured, and the larger taken as the base, though in no instance did the difference amount to more than one-eight inch. That the adjustment was made with a very close approximation to accuracy is evidenced by the fact that in the four cases where the profiles of the lines traversed were obtainable, and it was possible to check the distances, there was no perceptible difference between the distance given by the reading of the instrument and that of the engineer's stations. On the fifth profile the location of one end was impossible. It has, therefore, been taken for granted that the unchecked distances were as accurately measured as those which it has been possible to check.

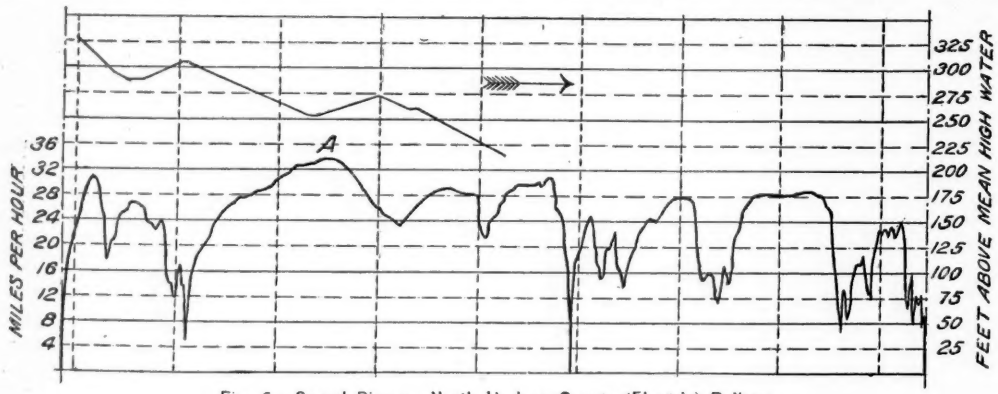


Fig. 6.—Speed Diagram North Hudson County (Electric) Railway.

While the subject of rapid transit is of interest mainly to long-distance travelers, it was thought best to show what all types of motors are doing, even though their competition might be limited to but a few blocks, and though very high speed with them would be entirely out of the question.

Horse Car.—Accordingly work was started with the old-time horse car, having a body 16 ft. long and seating 22 passengers, and weighing about 2,250 lbs. Fig. 1 shows the diagram of a run made by such a car from 138th street to the City Hall, over the Fourth and Madison avenue line The distance is about 8¼ miles and the average running speed, as measured by a plainmeter from the diagram was 6.78 miles per hour, while the highest speed, which was several times attained, was 9.94 miles per hour. In examining these diagrams it will be seen that the rate of acceleration for the lower speeds is approximately the same in all. In fact, in the case of the horse car the diagram rises almost vertically up to a speed of five miles per hour, but it will be seen that there is quite a distance traversed between the 5 and the 7½ mile mark. Measured as carefully as possible under a magnifying glass this distance is found to average 150 ft. The interesting feature is the unevenness of the speed of the horses, and the comparatively small number of actual stops that were made, showing that the majority of the passengers make a practice of boarding and leaving these cars while they are in motion. The average duration of the stop is also much less than with any other type of car, that for the 45 made between 138th street and the City Hall, being 5.2 seconds with a maximum of 10 and a minimum of one. This is probably due to the shorter distance from the step to the ground, and the slower speeds which serve as an inducement for passengers to start to leave the car before it has actually stopped. Of course this record cannot be taken as an influential factor in any scheme of rapid transit and is merely inserted here as a record of horse car performance.

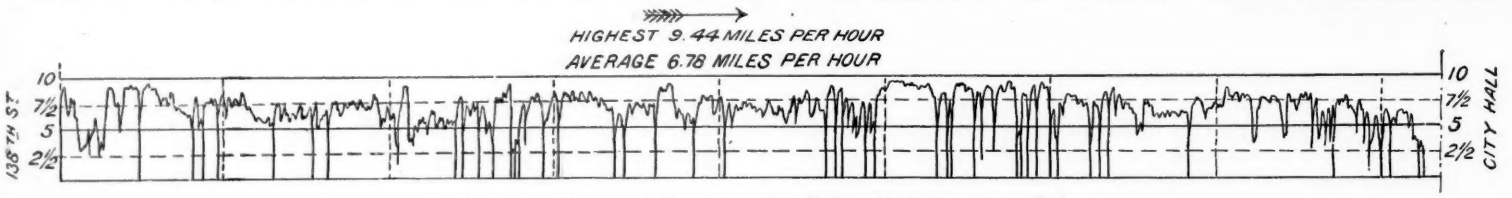


Fig. 1.—Speed Diagram of Horse Car—City Hall to 138th Street, New York.

Cable Car.—With Fig. 2 we come into contact with a true competitor for long-distance traffic, the cable car; but one that is hampered by a limitation of speed, and a limitation of that can be so closely controlled that any excessive increase beyond that sanctioned by municipal ordinance is impossible. The car upon which the instrument was placed was No. 468 of the Third Avenue Railroad, running on the line between First avenue and Fort George, by way of 125th street and Tenth avenue. Its weight is about 11,000 lbs. The speed of the cable is given as 10.3 miles an hour and the average speed of the car, as taken from a careful reading with a planimeter is exactly 10.3 miles an hour. As far as the diagram is concerned there is no acceleration; the grips can seize the cable and bring the car to a full speed within a very few feet. This is clearly shown in the diagram of the run down from Fort George. At Eighth avenue there was a stop on each side of the street and the speed attained between the stops was 8⅛ miles per hour, or within 1.8 miles of the full speed. It is probable that there was no slip of the cable in the grip at the center of the street and that the slowness was due to the stretching of the cable.

It is well known that the take-up of a cable in the power house is always in motion, but this does not represent all of the stretching and retraction to which the cable is subjected. The diagram shows that even though the grip may have a firm hold of the cable for a long run such as that between 158th street and Fort George, the speed of the car is not uniform. These oscillations of the speed occur 19 or 20 times to the mile and vary in intensity from one-half mile to three miles an hour. Thus we have in one case the car moving at a speed of 11½ miles an hour or 1.2 miles in excess of the actual travel of the cable; and, as this occurred on a very heavy up grade, it could not have been due to the car running ahead of the cable. The highest speed shown is at the cable-house on the down trip where 13 miles an hour was reached. This is on a down grade where the cable is released and the car allowed to drift past the deflecting pulleys.

It was thought that the variations of the speed of the car might be synchronous with the movements of the take-up in the power-house, but this is probably not the case. The oscillations of car velocity are much more rapid than those of the take-up, the latter averaging about 12 to the mile run of cable, and is the resultant of all the variations in length, while the car oscillations are due to the varying lengths of short sections of cable.

The effect of the higher speeds is shown by the higher average in the number of stops per passenger over those of the horse car. On the up trip here shown there were 17 stops, and yet only 14 passengers were carried. If we deduct three stops (at First and Third avennes and the power-house) where no passengers entered or left the cars and which were due to other causes we have one stop for each passenger carried. The stops are also of longer duration. The average of 77 stop-watch records on this line is 7.3 seconds, the longest being 28 2 seconds and the shortest one second; a wide range, and one showing how important it is for passengers to "step lively" if rapid transit is to be facilitated.

With the cable car, grades are of no moment so far as the acceleration to, and the maintenance of, the maximum speed are concerned. The diagram shows that the acceleration to the maximum speed on the heavy grade at 129th street was as rapid as upon the level track at Eighth avenue. A favorable grade is also a matter of indifference, except that the stop is a little slower, as shown by the down diagram at 130th street.

The cable car, then, finds its limitations in the speed of the cable, and unless the street traffic is so heavy that the cars are delayed by other vehicles, it may be counted upon to run with the speed of the cable less the time actually lost while standing still. It must come to a full stop for each passenger carried, which involves a loss of about seven seconds for each fare.

In the diagram of Fig. 2 the profile of the line is given from Manhattan avenue north. The road from that point through 125th Street is nearly level, but the actual grades could not be obtained.

Compressed Air.—Running in connection with the cable cars on 125th street are the cars operated by compressed air by the Hardie system. These cars were fully described in the issue of the *Railroad Gazette* for May 29, 1897. They weigh 18,200 lbs. each, and carry, when first charged, 51 cu. ft. of air under a pressure of from 1,600 to 2,000 lbs. per square inch. In making one round trip between the ferry and First avenue the loss of pressure is about 500 lbs. In the ordinary traffic they are run in between the cable cars, and their average speed is necessarily limited to that of those cars. Fig. 3 contains four diagrams taken with these cars. In the one marked *B* the average speed between the terminals was 10.2 miles an hour, or about the same as that of the cable cars, though at three places it was more than 16 miles an hour, and at one point it touched 17.75 miles. The car, therefore, possesses the ability to make up any time that might be lost on the cable schedule.

Regarding the rate at which the car can be accelerated and the speed at which it can be run, the limits of distance available upon 125th street were such that a final determination of the possibilities of the car from the data there obtained is impossible and would probably be unfair to the car. Taking these diagrams, however, we find that in one instance, on crossing Eighth avenue, the car attained a speed of 8.75 miles an hour, the distance being the width of the street between curbs plus the length of the car, which is one-quarter of a mile faster than the cable car acceleration already alluded to. As for the regular acceleration and speed, diagram *A* shows the highest that was attained. The car was run in ahead of the car that should have preceded it, and as the track had been somewhat cleared by the taking off of cars for the night, higher maximum and average speeds were attained than would have been possible with the regular working. On this run (*A*) from First avenue to the ferry an average speed, exclusive of stops, of 13.69 miles an hour was maintained, touching 22.5 miles an hour in a run of two blocks between Fourth and Sixth avenues. Taking the acceleration curve starting from First avenue, and plotting across to give the car the benefit of the speed there attained on the curve between Fourth and Sixth avenues, we obtain the following data for the acceleration to the various speeds:

								Ft.
Distance run to attain a speed of	4	miles per hour.....	18	(?)
"	"	"	"	8	"	"	.....	54.8
"	"	"	"	12	"	"	.....	166 4
"	"	"	"	16	"	"	.....	582.0
"	"	"	"	20	"	"	.....1,040 .0
"	"	"	"	22½	"	"	.....1,497.6

As these speeds were attained on a level track, or one

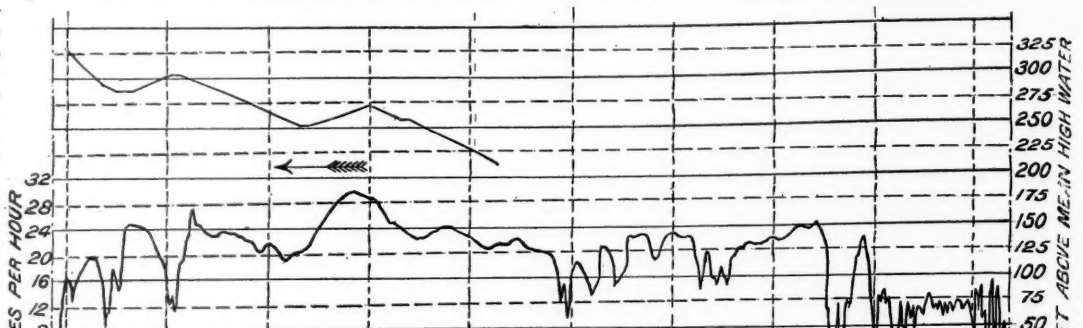


Fig. 5.—Speed Diagram North Hudson County (Electric) Railway.

nearly so, there is no reason why the speeds given should not be maintained until the air pressure shall have dropped below that to which it is ordinarily reduced for admission to the cylinders. During all of these runs, as well as upon those already given for horse and cable cars, passengers were carried in the regular course of the business of the company.

Electric Motors.—While the railroad public still regards the compressed air motor as an experimental machine, the electric motor is accepted as one for adoption and use. Two runs were made with this type of motor. One on the Nas-

sau Electric Railway in Brooklyn, N. Y., and the other on the tracks of the North Hudson County Railroad in Hoboken, N. J.

Fig. 4 is the diagram of a run from the station of the Nassau Electric Railroad at Twenty-third street and Fifth avenue in Brooklyn to Fulton Ferry, thence back over the same route to Coney Island and returning to the station. As loops are used at the terminals the motion of the car was not reversed, and the diagram is continuous.

The average speed as obtained from measurements with a planimeter is divided into three sections. One is from the station to Fulton Ferry and return, where the tracks are laid in the heart of the city and for a portion of the run traverse streets that are crowded with vehicles and pedestrians. Here the average speed maintained was 9.52 miles per hour. The second section extends from the station to the Coney Island terminal. The greater portion of this division of the run is through the open country where there is no impediment to fast running and an average of 13.95 miles an hour was maintained. The third section is the same as the first, but the run was made in the opposite direction; here the average speed was 14.7 miles an hour. On the first section the highest speed attained was a trifle more than 15 miles, though the majority of the high points between stops do not run much above eleven. The highest speed on the whole run was obtained in the section marked *C* between the station and Coney Island, where 22.17 miles an hour was reached. This, however, was at the foot of a steep grade and has been neglected in the estimate made of the rate of acceleration. Another point where nearly the same speed was obtained is marked at *D;* this too, was at the foot of a grade.

On leaving Coney Island the track is almost, if not quite, level to Ulmer Park, and it is uponwork done on this stretch that the estimate of acceleration is based. Between the stops marked *A* and *B* the motors were driven to the utmost of their capacity, except where the speed was checked for curves. Eliminating these curve retardations, and plotting the diagram continuously from the start to the attainment of the maximum speed, we obtain the following table of the rate of accelera tion:

								ft.	(?)
Distance run to attain a speed of				3	miles	per	hour...	21	(?)
"	"	"	"	6	"	"	..	42	
"	"	"	"	9	"	"	..	126.72	
"	"	"	"	12	"	"	..	221.76	
"	"	"	"	15	"	"	..	443.52	
"	"	"	"	18	"	"	..	1,150.62	
"	"	"	"	21	"	"	..	2,755.53	
"	"	"	"	21.58	"	"	..	3,573.2	

An interesting condition is here developed in comparison with the acceleration table given above for the air motor. From the very start it fell below the air motor, and with an increasing difference as the speed increased. To attain a speed of four miles an hour the electric car traveled about 55 per cent. farther than the air car; for 12 miles about 33 per cent. further, while for 20 miles it was 114 per cent. farther. In both cases the rails were dry and the weather clear. The weight of the electric car was 20,000 lbs.; it was carried upon four wheels, and was fitted with motors upon each axle, made by the Steel Motor Co., and known as their "C. No. 3."

The car was in regular service when the diagram was made, and a stop-watch record of the time lost while actually standing still for passengers gave an average of a very little less than seven seconds, or just below that given for the cable, though the range of time consumed at stops was wider, running from one second to 53 seconds, the latter being a station stop at Bath Beach.

The results obtained in this investigation were so at variance with preconceived ideas as to the work being done by electric cars that it was decided to try elsewhere in order to comfirm or refute this data. In the course of inquiry a letter was received from an engineer at the head of one of the electric companies, in which he said that "high-speed electric railroads are as yet mostly on paper. The cut-up service that electric motors are generally called upon to perform does not readily lend itself to high speed, and as a consequence commercial motors have been produced for comparatively moderate speeds."

Through the courtesy of Mr. Starr, General Manager of the North Hudson Co. Ry., a special car was obtained and a run for speed made on the section of road that was formerly operated by loco motives, and which runs along the crest of the Palisades. The car used was about 30 ft. long in the body, and was carried upon two bogie trucks fitted with two Westinghouse No. 800 motors to each truck, or four for the car. The total weight is estimated at 11 tons.

Fig. 5 is the diagram of the run out. The grade is plotted over the last portion of the line only, as it was not obtainable on the city section, where no attempt was made to obtain high speed. On the run out the highest speed reached was 29.6 miles an hour, but there were so many instances of slowing for curves and crossings that it has not been considered desirable to take notice of the acceleration obtained. On the return trip, however, the motors were driven to their utmost, and the rate of acceleration is interesting and easily obtained. It will be noticed that that the highest speed, 33.5 miles an hour, shown at *A* of Fig. 6, was obtained at the foot of a down grade, which materially assisted the motion of the car. If we take the curve of acceleration at the start and use it up to 28 miles an hour and then project over to the curve that rises to the highest point, an arrangement giving the greatest advantage to the electric motor, we obtain the following schedule of acceleration:

							Ft.
Distance run to attain a speed of				4	miles	per hour..	21.12 (?)
"	"	"	"	8	"	"	42.24 (?)
"	"	"	"	12	"	"	168.96
"	"	"	"	16	"	"	295.68
"	"	"	"	20	"	"	549.12
"	"	"	"	24	"	"	999.28
"	"	"	"	28	"	"	1,182.72
"	"	"	"	32	"	"	3,294.72
"	"	"	"	33 5	"	"	4,899.84

The acceleration is very much more rapid than it was in the case of the other car. For example, the four-motor car was running 12 miles an hour at the end of 168.96 ft., while the two-motor covered 221.76 ft. in attaining the same speed, but one did its work on a level and the other on an average down grade of 46 ft. to the mile or an inclination of .87 of one per cent. As there is no way of determining what the internal resistances of this car may have been it is unsafe to assume any data by which the above rate of acceleration could be reduced to the work on a level. But if we should take these resistances to be 15 lbs. to the ton, the car, in drifting the distance required to attain a speed of 33.5 miles an hour, would have been moving something more than 13 miles an hour, and in the distance required to attain a speed of 20 miles it would have drifted to a velocity of about 4.6 miles per hour. Carrying out this ratio for the whole table, we find that the actual rate of acceleration for the work of these motors when reduced to work on the level varies very little from that given for the two-motor car; but whether the acceleration shall appear greater or less will depend upon the coefficient of internal resistances which we assign to the motor. It is, therefore, evident that the commercial motor as we find it in common use is not adapted for a rapid acceleration to high speeds or the maintenance of those speeds on a level even if favorable grades should render their attainment possible. This statement, however, must not be taken as a denial of the possibility of building a high speed motor, but merely in the form of an assertion that they could not be found working, at least in the vicinity of New York.

(TO BE CONCLUDED.

The Barnes Feed-Water Heate r.

The feed-water heating arrangement illustrated by the accompanying cuts is the invention of Mr. J. B. Barnes, Superintendent M. P. & M., Wabash Railroad. It is very simple, as will be seen from the cuts, which are self-explanatory. The steam from the air-pump exhaust is led back to the tender, where its heat is given up to the water in the tank. The apparatus for accomplishing this consists of a three-way cock placed just in front of the air pump; a lever controlling the direction of the exhaust, throwing it into the stack or tank: a 1¼-in. pipe running from the three-way valve to the stack, and from the valve back toward the tank; a separator placed in this pipe back of the pump; a valve and

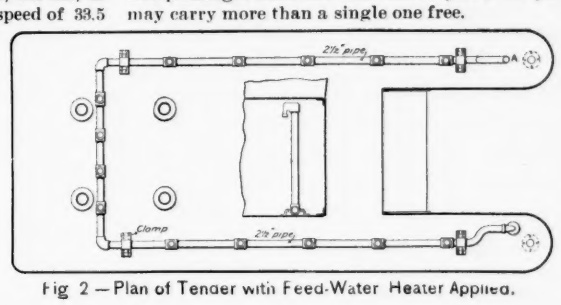


Fig 2.—Plan of Tender with Feed-Water Heater Applied.

jector, the exhaust can be turned into the stack, when there will be no more heating. As the water recedes in the tank less heating surface is in contact with it, hence there is a tendency for the water to remain at one temperature.

There seems to be no question of the results that will come from this device as a fuel economizer, while the practical utility in diverting the air-pump exhaust from the stack into the tender, putting it where it is a real benefit, is considerable.

Railroad Legislation in South Carolina.

The Legislature of South Carolina, recently adjourned, passed the following bills:

No. 23 requires all railroads to erect "depots" whenever and wherever ordered by the Railroad Commissioners, under penalty of $5,000 for failure to comply.

No. 42 declares that bicycles shall be deemed baggage to be carried under the same rules as govern trunks. The passenger need not crate the bicycle; no passenger may carry more than a single one free.

No. 69 seems to be designed to hasten the settlement of loss and damage claims. Common carriers must pay or refuse to pay such bills within 60 days; and in case of failure or refusal to pay shall be liable to a penalty of $50 for each offense.

No. 80 makes penal in South Carolina the doing of any act by a railroad which violates the Interstate Commerce law. There are heavy penalties, and infraction of this law shall constitute a ground for the forfeiture of a railroad's charter. The act is crudely drawn.

No. 88 amends the law of 1896 which empowered the Railroad Commissioners to compel the running of trains on connecting roads so that they shall make reasonable connections at junctions; the Commissioners may now require the running of at least one "unmixed" daily passenger train each way, except on roads in the hands of receivers.

No. 114 makes railroad corporations liable for damages to land from the wrongful obstruction of water courses; it shall not be necessary for the aggrieved party to show that the damage resulted from negligent construction of the railroad; all he need show is that the obstruction is wrongful.

No. 118 provides a penalty of $100 a day for owning, leasing or operating a competing railroad. Any citizen may sue for this penalty, and half of it shall go to him when recovered.

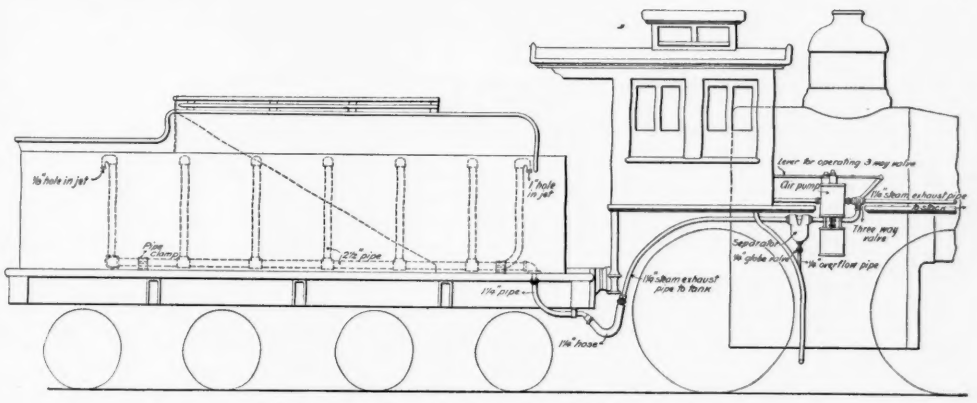


Fig. 1.—Barnes Feed-Water Heater Attached to Engine.

overflow pipe from the separator, and a steam hose and connections in the 1¼-in. pipe, as shown. The purpose of the separator is to dislodge oils or other foreign matter which might tend to get into the tank and thence into the boiler through the feed-water. It can readily be blown out when occasion may require. The use of this device is, however, merely precautionary.

Around the bottom of the tank lies a 2½-in. pipe, with 15 upright pipes, as shown in elevation, Fig. 1, and plan, Fig. 2. At the upper end of each vertical pipe a gooseneck is attached. The nozzle of each neck, except the last one at the end of the horizontal pipe, is reduced to a ¼-in. hole. The nozzle of the upright at *A*, Fig. 2, has a 1-in. opening. The object of the larger opening in this last pipe is to induce the exhaust to follow the horizontal pipe to the end, carrying with it the condensation from the horizontal pipe and the vertical pipes with the smaller openings, which smaller openings are for the purpose of giving vent to the exhaust and keeping the uprights heated.

The water in the tank can be heated to 100 deg. Fahr. or more. Should the water become too hot for the in-

No. 151 is an act to consolidate, under the name of the Atlantic Coast Line Railroad Company of South Carolina, the six railroads now composing that line within the state. This bill, we understand, has not yet been accepted by the corporations interested, and it is doubtful whether they will accept it. The bill forbids the company to own a majority of the stock of any parallel or competing road and provides for cumulative voting for directors. It does away with the exemption from taxation now enjoyed by the constituent roads.

No. 163 requires the owners of abandoned or unused railroads to organize, if not organized, and to put the road in operation within 60 days, under penalty of $50 a day, unless reasonable cause for failure to operate can be shown. This does not apply to short lines constructed for special or temporary use.

No. 164 forbids tax assessors and collectors assessing or collecting any tax for the payment of township bonds that have been issued in the aid of a railroad which is not completed through such township. Newberry County is excepted from the provisions of this act.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
Published Every Friday.
At 32 Park Place, New York.

EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

Elsewhere in this issue will be found a communication by Mr. Vauclain in reply to a discussion by *The Engineer* (London) of a report made by us of a certain run made last summer on the Chicago, Milwaukee & St. Paul Railway. We do not care now to add anything to what Mr. Vauclain has said other than a word of apology for the somewhat misleading profile which we published with that report. Had we given the relative altitudes, or even the vertical scale, our contemporary would perhaps not have assumed that the *average* rise in five miles was 26 ft. per mile instead of less than 9 ft., as was the case. In fact, however, we did not attach so much importance to the run as our contemporary does, for it does not seem so extraordinary a performance on this side of the water, where we are accustomed to locomotives of great power hauling very fast and heavy trains. We question very much if Mr. Vauclain's argument will be entirely satisfactory to our contemporary even with the correction made as to the grades surmounted. We doubt, for instance, if the English editor will admit that the coefficient of adhesion can be so great as one-fourth. He takes it arbitrarily as one-sixth and will probably say that the burden of proof is on us to show that it is more. We believe that all American authorities agree that one-fourth is a safe coefficient for a dry rail, and long, extensive and successful practice in locomotive design and working confirms them. The run in question was made on a clear, warm day, when the coefficient of adhesion might well have been greater than one-fourth rather than less. *The Engineer* has long dissented, also, from American notions as to train resistances, and it is very likely that it will not accept the low resistances shown by Mr. Vauclain. But we assure our contemporary that the run was actually made in the time and with the weights as given in our issue of Jan. 22. For this we have the testimony of men whom we cannot doubt.

Mr. Henry M. Sperry is one of the most conservative as well as one of the most progressive of American signal engineers, and a paper by him, such as we publish on another page of this issue is, therefore, well worthy of the attention of every one interested in railroad signaling. Mr. Sperry deals with real questions in a rational manner and does not waste his energies on theoretical abstractions (though we think that the credit he gives to the American Railway Association is justified by courtesy rather than by any marked service that that body has done to promote progress in the department of signaling dealt with in this essay). The reminder that slip switches should be avoided wherever possible is an example of conservative counsel that should be emphasized, though it is quite possible that this counsel will, if followed, slightly diminish the business of the signal manufacturers, including the concern with which Mr. Sperry is connected. The question of a third color for night signals is given up too readily. We repeat what we have said before, that we make no radical or strenuous objection to the combination red-and-green lights used on the Chicago & Northwestern, but we also repeat that the third-light question has not yet been really discussed, with any thoroughness, on its merits. Deciding that violet or blue or amber cannot be used in a signal lamp does not settle the question, for we still have left the simplest of all the solutions that have been offered, the use of white for caution in a distant signal. What objection has been offered to the use of white, in this way except that based on the vague feeling that the change would produce too great a disturbance of the inertia of present habits? The adoption of green for all-clear, which Mr. Sperry looks upon as already pretty well accepted, is a much more radical innovation, for it has to do with positive signals, and green for all-clear is directly inconsistent with the use of green for caution, which continues to prevail in hand-lamp signals and on engines and cabooses. If we can endorse this inconsistency we certainly ought to be able to deal with a change which at the worst makes trouble only temporarily. Judging from success with other changes heretofore made, one may safely say that there would be no trouble at all. Again, it is a simple thing to make a white distant signal distinctive, as regards any possible confusing light, by using a mirror and presenting to the engineman two lights, side by side, using but one flame. This is what Mr. Carter does with his colored lights in the Chicago & Northwestern signals.

Some of the Possibilities of Refunding.

The refunding of the Lake Shore 7 per cent. bonds at 3½ per cent. (which we described last week) is an example of a procedure which promises to exercise a powerful influence on railroad finances during the next 20 years. The *Financial Chronicle* has compiled a list of railroad bonds falling due before the end of 1905, and bearing 5 per cent. or more. This list does not include bonds of defaulted roads (except one or two large properties), but does include three properties not railroads, viz., Lehigh & Wilkes-Barre Coal, Lehigh Coal & Navigation and Western Union. This list foots up $710,689,262. Refunding these at 4 per cent. would save $17,000,000 a year; at 3½ per cent., $20,000,000. Of course this debt cannot all be placed at 3½ or even at 4 per cent.; but a large part of these bonds are likely to be refunded several years before the average maturity and it would seem that a portion of the losses due to low rates is to be partly offset in the case of many important systems by decreases in fixed charges. The course of events in the financial world—anti-corporation legislation, failure of farm mortgage companies, inability of Eastern lenders on Western real estate to realize in many cases the principal loaned, and the practical wiping out of junior securities of great industrial and railroad companies—has led to sharp discrimination in making loans. Instead of an average rate of 6 to 8 per cent., the lesser security is now asked, 10 to 12 per cent., and that of "gilt edge" character 4 to 5. This is one of the reasons why a first-class, long-term, railroad bond can be placed at a yield equaling one-half of the rate of interest paid on old bonds.

The railroads will not be slow to take advantage of the obvious advantage thus afforded. It means solvency to some and dividends or increased payments on stocks to others. Moreover, when a road has a series of bonds maturing from 1898 to 1905, the saving in interest by funding a 6 or 7 per cent into a 4 per cent. is so great, that many funding plans are likely to be hurried rather than delayed. A number of systems of the class of Lake Shore are likely to lead in this movement.

New York Central bonds to the amount of over $70,000,000 mature within the next 8 years. Of this amount, $30,000,000 draw 7 per cent., $9,733,333, 6 per cent. and $11,000,000, 5 per cent., the balance, 4 per cent. Chicago & Northwestern has maturing about $22,000,000, on which it could save over $600,000 a year at 4 per cent. Chicago, Milwaukee & St. Paul has outstanding more than $55,000,000 of bonds falling due before the end of 1910. Of these, $3,674,000 of 8 per cents. mature next year, and there are over $30,000,000 7 per cents. The yield of these various issues, figured at the current market price, is not on the average over 4 per cent. and in some instances is less.

There is hardly a railroad company which has not passed through a reorganization in recent years that has not a direct financial interest in this matter. The saving in fixed charges from such refundings as seem entirely possible in the next decade may be enormous. The *Chronicle* gives a list of the debts of eleven great companies, amounting to about $421,000,000, on which $9,700,000 a year could be saved at 4 per cent., or $11,800,000 at 3½ per cent.

Western Lumber Production.

The *Northwestern Lumberman's* elaborate statistics of the production of white-pine lumber show a very large decrease in 1896, in comparison not only with the previous year, but with any other year since 1880. There is perhaps no other industry, except the iron industry, which reflects so well the general business condition of the country; for lumber is a leading material of construction, and when industries make poor returns, when their capacity is much greater than the current consumption, few new constructions are undertaken. Thus in hard times the iron and timber industries suffer more than almost any others.

It is true that the production of white-pine lumber is limited not only by the demand, but also, and very decidedly, by the accessible area of white-pine forests. This is a crop which it requires the lifetime of several generations to grow, and practically once harvested it is never renewed. As long ago as 1870 it seemed that the maximum production had been nearly reached, and well-informed students of the subject believed that before another census was taken the supply must fall off for lack of trees. But the maximum production was not reached until 1892, when it was more than twice as great as in any year before 1879. The decrease in production after the panic of 1873 was hardly as great as might have been expected. In *millions* of feet the production was.

1873.	1874.	1875.	1876.	1877.	1878.	1879.
3,994	3,751	3,969	3,879	3,595	3,629	4,807

In explanation of this it should be observed that for several years before the panic of 1873 there had been a great extension of railroads through new prairie country in the Northwest, which could not grow at all without drawing lumber supplies from this district. The new country, it is true, grew slowly on most of these new lines during these years, but without this newly opened market, the lumber production certainly would have fallen off much more than it did. The full effect of prosperous times is shown in a striking manner by the sudden increase of one-fourth in production from 1878 to 1879. But that was only the beginning of the expansion. For the next five years the production was (*millions* of feet):

1880.	1881.	1882.	1883.	1884.
5,651	6,769	7,552	7,625	7,935

From 1878 to 1882, thus, the production more than doubled. In 1885 it fell off one-ninth, and then grew moderately until 1888, and for six years ending with 1890, it was:

1885.	1886.	1887.	1888.	1889.	1890.
7,053	7,425	7,758	8,389	8,306	8,665

And for the last six years it has been:

1891.	1892.	1893.	1894.	1895.	1896.
7,943	8,903	7,600	6,763	7,093	5,538

The enormous requirements of Chicago for the World's Fair constructions doubtless had a decided effect on the production of 1892, but for the five years ending with 1892 the average production was at the average rate of 8,440 millions, and this probably will remain the culminating period of the industry.

The panic of 1893 came early enough to have a decided effect on the production of that year, which, however, was much larger than the consumption, the stock on hand at the mills having increased 527 millions during the year. The full effect of the stagnation of business was to be expected rather in 1894, when in reality the production was nearly one-fourth less than in 1892 and a ninth less than in 1893. In 1895, recovery (in production) began, as in many other industries; but that the relapse was more serious than the first illness is shown by the great reduction of 22 per cent. from 1895 to 1896, when, as we have said, the production was the smallest since 1879.

Here again, however, the production does not indicate properly the course of consumption. To indicate the latter as nearly as possible, we have to add or subtract the increase or decrease in the stock on hand during the year. We have the figures for the stock on hand at the mills, but of course not of the stocks in yards. Allowing for the changes in mill stocks the consumption, or rather the amount of lumber marketed by the mills, has been in *millions* of feet:

1892.	1893.	1894.	1895.	1896.
9,112	7,073	6,870	6,851	6,082

This indicates that the consumption was nearly the same in 1894 and 1895, and last year not 22 per cent., but only 11 per cent. less than the year before.

The extent to which certain railroads in the lumber country have had their traffic affected may be seen by the following: Mills on the Chicago & Lake Michigan Railway which in 1882 produced 207 millions of feet, and for the eight years ending with 1892 averaged 117 millions per year, since then have turned out, in the four years successively, 53, 31, 34 and 8½ millions; on the Grand Rapids & Indiana, where the pro-

duction from 1881 to 1889 ranged between 222 and 367 millions a year, it was only 140 in 1895 and 96 last year; on the St. Paul & Omaha road the reduction from 1895 to 1896 was 35 per cent.; on the Chicago & Northwestern's other great lumber line, the Milwaukee, Lake Shore & Western, it was 29 per cent.; on the Wisconsin Central, 37 per cent.; on the Wisconsin Valley Division of the Milwaukee & St. Paul, 27 per cent. This traffic is a very large part of the total traffic of all these Wisconsin lines

For the coming season, however, business may improve. There can hardly be a large production, for the log harvest is in winter, and not only has the condition of the market prevented preparations for a large output, but the weather has been very unfavorable, and that has a tremendous effect. Consumption, however, is not necessarily limited as much as production, for the stock of timber on hand at the mills is always a large proportion of a whole year's consumption, and at the close of the season it was nearly 60 per cent. of last year's production. Should there be hereafter during this year a revival of the demand, it could probably be met without much difficulty by reducing this stock, though not without a material advance in prices.

Some Considerations on "Rapid Transit."

On Thursday night of this week a paper was presented before the New York Railroad Club, on Rapid Transit, by Mr. W. L. Derr, a Division Superintendent of the Erie Railroad. We write too early to say anything of the discussion of this paper, which was doubtless interesting and suggestive. We venture, however, to present now a few fundamental considerations.

The question is big and pretty complex, and in beginning any discussion of it it is well to know what we are talking about. Mr. Derr defines rapid transit as "the quick movement by railroad of people from one point to another in and about large cities." But what is quick movement? Is it eight miles an hour or is it 25 miles an hour? This the definition failed to define. But just here is the starting point. In designing a rapid transit system we must settle on some average and maximum speeds that we shall aim to realize. The speed must control, and to this everything else must be subordinated. If we can get along with 10 miles an hour, street cars run by electricity or cable will serve the purpose better than any rapid transit scheme that we have ever seen proposed, for they are more accessible and the passenger is not obliged to go to a station to board his car.

Mr. Derr elaborates his definition somewhat by saying that the first requirement in rapid transit is "the prompt movement of passengers from all points near by and outlying to the business localities of the city." This, he says, is a fundamental principle, and this necessitates express as well as local trains. Further requirements are frequent trains, good station accommodations, low fares, good ventilation and light. He omits, however, one very important requirement, and one which has a controlling effect on speed; that is, frequent stations. A city rapid transit system cannot pay without very frequent stations, simply because it cannot get business enough, and here again we run into the question of speeds, because the more frequent the stations the lower the speed, other things being equal.

By way of an attempt to get a starting point and to ascertain what speeds we may hope for or must aim for, we will consider some instances of actual practice, and will take first the Manhattan system in New York. Here the best speed reached in local service is 14.4 miles an hour for 10.7 miles, with 28 stops—that is, the stops average one for every 0.36 mile. This is a fine performance; we suppose that, considering the number of stops, nothing better is done anywhere. A difficult, and what we should call successful, service is given on the Ninth avenue line, from South Ferry to Forty-second street, 4.23 miles, at an inclusive speed of 12.4 miles an hour, making 15 stops, or one stop for every 0.28 mile. From South Ferry to 129th Street, on the Third avenue line, 8.43 miles, the average speed is 12.7 miles an hour, with 27 stops, or one to every 0.31 mile. Between the same stations on the Second avenue line, almost the same service is given—that is, 8.73 miles are run at 13.1 miles an hour, making 27 stops, or one every 0.32 mile. These are local trains making all the stops.

The express trains, of which there are a great many, run at just about 18 miles an hour from terminus to terminus. From Rector street to 155th, 9.57 miles, the speed is 17.94 miles an hour with 12 stops, an average of one for every 0.8 mile. From Franklin street to 116th, making two stops, the distance of 6.8 miles is run at a speed of 20.7 miles an hour.

Incidentally, it may interest a good many people to know how many express trains are run in this service. On the Sixth and Ninth avenue lines from Rector street to 155th there are 29 northbound trains between 2:24 and 6:20 in the afternoon, and besides this there are four northbound trains starting at Franklin street on the Sixth avenue line and running as far as 155th. The southbound service is about the same. In the busiest hours these trains are dispatched every five minutes. On the Third avenue line there are 14 northbound trains starting from the City Hall station at intervals of eight minutes, and there are 19 southbound trains in the morning. To these must be added three trains northbound in the afternoon, starting from the City Hall and nine starting from Canal street destined for Tremont avenue, and there is a similar service south in the morning. It will be seen that the Manhattan gives a very fine express service.

The speeds which we have given above for the Manhattan system are better than those made on the London Underground, and when we take into consideration the number of stops made they are very much better. From the Mansion House to Richmond, 10.75 miles, the speed is 12.9 miles an hour, making 15 stops, or one for every 0.71 miles. This should compare with the run from South Ferry to 155th street, almost precisely the same distance, at 14.4 miles, making 28 stops. From the Mansion House to Kensington, 5.2 miles, the speed is 10.8 miles an hour, with nine stops, or one every 0.58 mile. This compares with the Ninth avenue line from South Ferry to Forty-second street, 4.23 miles, speed 12.4 miles an hour, with 15 stops.

We have not before us the working time-tables of the elevated railroads in Chicago, and cannot say precisely what speeds they make, but we are informed that the Metropolitan makes an average of a little more than 14 miles an hour between terminals.

Speed in railroads of this character is chiefly a question of acceleration and of stopping. Very little of the run can be made at top speed by the local trains and only short distances by the express trains. We may forecast some improvements in present common practice. Electric motors will give quicker acceleration by virtue of the conditions under which they use power. With them we may even get more of the weight of the train for adhesion by multiplying the drivers, and it is possible that motors will be put under two or more cars in a given train, thus increasing the weight available for traction; although the prevailing opinion among engineers seems to be pretty decidedly against such a multiplication of mechanism. We may expect that in some cases quicker stops will be made by the use of a brake of greater power. Probably not many years will pass before the vacuum brake now used on the Manhattan system will give way to the compressed air brake. But the comfort of passengers will eventually set a limit to the quickness of the stops.

Without going into the difficult figures involved in an analysis of the conditions which would determine the limit of weight and power that can be put into motors with economy, and the maximum rate of acceleration that can be got with the maximum motor, we may perhaps assume that speeds for trains stopping every fourth or third of a mile can make about 15 miles an hour from end to end of run, and that trains stopping every mile may make 25 miles an hour between terminals; and perhaps these figures are as good as any, as an expression of the speed requirements of a city rapid transit system.

But there are commercial limits to speed, quite distinct from the mechanical limits. If experience teaches anything it teaches that rapid transit enterprises in great cities are very dangerous. Of the three elevated railroads now running in Chicago, two are in the hands of receivers and the other is in deep water. Of the two great underground railroads in London, the Metropolitan paid (in the latest year of which we have a report), less than 3 per cent. on its common stock and about 3½ per cent on all forms of its indebtedness. The Metropolitan District has paid nothing for years on its common stock; it does pay something, however, on preferred stock and other forms of indebtedness, and the average payment of all its debt is a little less than 2 per cent. We have seen no recent reports on the experience of the little City & South London Railway, but for a good while it did not earn interest on its bonds.

It will be seen that financial results of actual working show the necessity for pretty careful limitation of structure and equipment. Other experience teaches the necessity of putting your stations so close as to get the short-distance traffic. This is, indeed, all-important for any enterprise so costly as a high-speed railroad in a city must inevitably be. The express traffic can go only a little way toward helping to pay working expenses. This is a proposition that we have made before and have tried to sustain by figures, from experience. Recently, a very able analysis of one day's traffic on the Manhattan system was made by Mr. Theo. Cooper, and the reader who is interested should consult that in the *Railroad Gazette*, Sept. 11, 1896; also a reply by Mr. Parsons in the issue of September 25. Mr. Cooper found that of the elevated railroad traffic 63 per cent. goes less than four miles and 75 per cent. less than five miles and the average journey was 3.4 miles. But for traffic going only five miles, great facilities must be given in the way of frequent trains and frequent stations and relatively high average speed, or passengers will board the surface cars at the nearest corner. So we come down to the two irreconcilable conditions —high speed and frequent stops.

We have tried to present some of the strict conditions which must govern any intelligent study of a rapid transit enterprise in a great city. How far the use of electricity as a motive power is destined to modify these conditions we are not now prepared to say, but we do not share the sanguine anticipations that are often expressed. It is very difficult to get figures of cost of working which will enable one to make any close comparison, and we shall leave conjecture on this point for further study.

Some Modern Law Making.

Several of the free and-easy legislatures that have distinguished the year 1897 have now adjourned, and from one of them, that of South Carolina, we have a report, which will be found in another column. A prominent characteristic of nearly all American legislatures for several years past has been the crude and careless language of the bills passed, and that characteristic appears here.

The bill requiring damage claims to be promptly adjusted, for instance, is a well-meaning bill, intended simply to prevent a railroad from worrying a consignee by needless delays (and in view of the unbusinesslike customs prevailing in some of the claim offices no reasonable person can object to the purpose of such a law); but the act is so clumsily worded that the first railroad that determines to defy it will probably have little difficulty in doing so successfully.

The law attempting to prevent discrimination in freight rates will also prove worthless. The Interstate Commerce law cannot be thus easily transplanted; its phraseology is too closely fitted to the precise circumstances with which it is intended to deal. In passing this bill the South Carolina legislators evidently aimed to shine as savers of labor and of paper and ink; but the outside observer, looking at the result, will probably class their work in this bill simply as the champion manifestation of laziness. The only fellow that can beat this job is the Kansas member who succeeded in consolidating his anti-trust law, a social purity bill, an insolvency law and a revision of the entire penal code of the State in a single bill made up of 15 verses from the 20th chapter of the Book of Exodus. Why could not an intelligent South Carolina clerk have redrafted the Interstate Commerce law, fitting the language to that State? It would not have cost five dollars.

The bicycle law had to passed, we suppose, simply to keep in fashion. The state that does not pass a law on this subject is too far behind the times to be worthy of notice. Here, again, the law can easily be nullified if any railroad so desires. The wheels are to be carried under the same rules as trunks; and trunks certainly could be reasonably subjected to a rule that each piece too fragile to be piled up with the common run of other baggage should be made to pay from 10 to 50 cents extra.

But for a thoroughly unmixed blessing, the law requiring the running of unmixed trains should take the palm. Probably our South Carolina friends have in mind long trains of lumber and fertilizer and other stuff, that detract so palpably from the eclat that naturally belongs to a passenger train, and we do not blame them for desiring to avoid stops for refreshments at every sawmill along the road; but we doubt whether they have accomplished their purpose. What is an unmixed train, anyway? Mail, express and passengers make a considerable mixture—not to mention baggage. For our part, we should prefer to allow the railroads the fullest freedom in mixing their trains, so as to encourage them to run as many as possible. Often a passenger-car can be run at a profit—or without loss—if a few freight cars are taken along to help pay expenses, when it could not be run if there were no income but that from the passengers. The true way to improve the service, if the state must improve it, which is doubtful, is to require a certain degree of speed or frequency. On the New York Central a passenger can save time by taking a mixed train, one of the fastest trains from New York to Chicago being one in which one or two passenger cars are "mixed" with five or six mail cars.

There is one South Carolina law whose meaning is quite unambiguous, though the official blunderer has succeeded in making the language decidedly confusing, and the bill has been made to differ from its title. We mean the bill forbidding the payment of town bonds issued in aid of proposed railroads. This is repudiation, pure and simple, or is intended so to be, and sufficiently attests—what, however, was known before—that the

South Carolina Legislature has aimed, in its attempts to exemplify genuine populism, to lead all leaders.

The Interstate Commerce Commission has decided that the posting in a station of a notice that freight rates are on file in the office and may be examined upon application, does not constitute compliance with the law. From the opinions expressed by some traffic men within the last few years we suspect that this view will be news to some of them. The decision is by Mr. Prouty, the new Commissioner. Whether any of the older Commissioners have expressed approval, informal or otherwise, of the practice now condemned, we do not know, though an impression that such an approval has been given seems to have prevailed to some extent. The present decision is in the case of W. R. Rea vs. the Mobile & Ohio. This shipper sends beans and tomatoes from Verona, Miss., to East St. Louis and complains because the beans are charged very much higher than tomatoes. The Commission holds that the difference is too large, but refrains from issuing an order, hoping that the railroad will remedy the inequality without formal action by the Commission. It appears that from Prichard, Ala., and from Verona, Miss., 271 miles apart, the rate to St. Louis is the same, while north of Verona it falls rapidly. The Commission holds that this group rate is *prima facie* unreasonable, discriminating against the towns in the northerly part of the territory to which it applies. The whole case is left open to permit readjustment of rates by the road, with leave to either party to present new evidence. The same decision also orders reparation for an overcharge on a shipment to Cleveland, O., due to the blunder of the station agent in refusing to bill through by a route which he had a tariff for.

The concession to Russia for a railroad through Chinese Manchuria makes the Siberian Railroad a much more feasible and a very much more promising project. The original plan, starting from the Russian Pacific harbor of Vladivostok, sent the road, whose general direction is westward, more than 400 miles northeastward, where first it could turn the extreme northeast corner of China and proceed then up the Amoor River by a winding and, for a long distance, very difficult route, to Lake Baikal. The Manchurian Railroad will extend from a point very near Vladivostok nearly at right angles with the original route northwestward, and will join the Siberian line some 400 miles east of Lake Baikal, at Onop. The distance is about 1,280 miles from Vladivostok to Onop by this route, against 1,620 by the other; 950 miles of it is in China. But what is probably even more important for the prosperity of the enterprise is that the Chinese line is likely to afford several times as much traffic as the other, especially with the branches which the concession authorizes, which give it a Pacific harbor 600 miles further south, open in winter, and near the great Japanese and Chinese markets. It must be remembered that this new line will make useless as an outlet for the Siberian Railroad the line from Vladivostok northeastward, known as the Ussuri Railroad, a large part of which is already completed.

The strike of the freight handlers of the Flint & Pere Marquette, at Ludington, appears to have completely failed, the road having secured enough men, after the Court enjoined the strikers from interfering, to keep freight moving. By Monday of this week over 100 of the old men had returned to work. The press despatches intimating that the Court, in issuing the restraining order, refused to forbid strikers to "go on railroad property" to persuade new workmen to quit, were not founded on fact. The question of going upon the railroad company's premises is not touched upon at all in the order, which reads: "From interfering with or obstructing in any manner the freight handling business of the Flint & Pere Marquette Railroad Company in and about its warehouse and docks in the city of Ludington; from the use of threats, personal violence or intimidation against any of the freight handlers or employees of said railroad, and from using any other means calculated to terrorize or alarm them or their families." The presence of a small crowd of men within a freight-house yard has many times proved to be a means of producing terror or alarm, and might do so in this case; so that any troublesome interference with the new men would clearly be punishable as contempt of court. Two or three men were arrested at Ludington for violation of the injunction.

TRADE CATALOGUES.

Roll Drop and Drop Forged Commutator Bars.—The Forest City Electric Co., Cleveland, O., has recently issued a 14-page, 6 × 9-in. catalogue, which presents by a carefully prepared description and engravings the drop forged commutator bars made by that company. The catalogue contains a list of some of the railroads which are using the bars, together with many letters commending their quality and durability. The protected rail bonds are also described, and the manner in which they are placed on the rails is illustrated. A table giving the angle chord for different divisions of the commutator is found at the close of the catalogue. This chord shows the increase per inch in thickness of a commutator bar of any particular angle, which is also the thickness of a division of a commutator of 1-in. radius, including the mica.

Street Railroad Construction.*

The advent of the electric motor has caused a revolution in construction methods. But, although this resulted in a heavy and costly construction, it is not by any means as durable as was hoped for, with the introduction of the girder rail and its long and heavy joints.

One cause of much tribulation is that the joints are permitted to remain too long without attention, and the removal of the paving delayed until it is absolutely necessary to make repairs. The possibility of continuous rails will eliminate this trouble to a great extent. Electric-welded or the cast-welded rails are practically continuous, the cast-welding being the less expensive. There are now over 200 miles of these continuous rails in use, and they appear to give satisfaction. Large ties, close spaced, in or on concrete foundations, will give good support to the track. It is costly, but necessary. It is generally believed that the rail should have an elastic support, yet we find on cable roads the rail resting directly on the cast-iron yokes with good effect, and no harm to rails or cars. Metal ties, in place of the large timber ties, thoroughly bedded in concrete, would be an improvement on the ordinary work. Perhaps a rail with a broad base laid directly on the concrete, thus altogether eliminating the ties, would be sufficiently solid. This plan has been adopted in Minneapolis and Europe with girder rails. There is one thing certain—the elimination of wooden ties will effect an enormous saving in repairs.

Road-bed.—Where necessary, the road-bed should be well drained with tiles, laid directly under the track, and the trenches filled with coarse material, gravel or broken stone. This drain should be laid 3 ft. below the track grade. The width excavated for the foundation of the track should be 2 ft. greater than the length of the ties. The depth depends upon the height of the rail, thickness of ties, depth of the concrete, etc., usually 8 in. below bottom of tie.

The Twin City Rapid Transit Co., Minneapolis, has adopted a near approach to permanent track construction. The rail is 5 in. × 5 in., T section, weighing 80 lbs. per yard, but with a depth of 7 in. it is thought much better results would be obtained. The rails are laid and brought to grade and line while supported on temporary wooden ties (as shown in the *Railroad Gazette*, March 12, page 184). As the work progresses, after the spaces between the cross-ties and under the rails are concreted, the ties are removed and all holes are filled with concrete. Granite blocks are set along the inside of track and left from 10 to 14 days for the cement to thoroughly set, after which an asphalt surface is laid in the usual manner. Sufficient time must be given for the concrete to harden before the track is put in service. Under each rail, running the full length of track, is what might be termed a concrete beam, 15 in. wide and 8 in. deep, on which the rail rests. It will be observed that no timber enters into the construction, and the only part to wear is the rail.

Metal ties require for their proper foundation a thorough bedding in concrete, and as a concrete foundation is necessary in any good track, the selection of metal ties bespeaks good judgment in deep-rail construction; but, curious to say, most American engineers claim that concrete is not necessary in first-class track construction, and if this opinion be correct then there can be few cases where the metal ties would be satisfactory and economical. Creosoted ties last twelve years, while untreated ties seldom last over six years. Dividing up the cost per annum, it is about the same for each, viz., 9.5 cents per annum; but with the creosoted tie, there is the expense of renewals saved once every twelve years, quite an item of importance to railroad managers. Insure 120 in. of bearing surface to each 30-ft. rail.

The rail should be mounted on a tie-plate, and many roads use tie-rods to keep the track in gage, but the best method is to use a combination tie-plate and rail-brace. Plates with a raised lug to prevent the rails spreading, and with claws to hold them to the tie, answer several purposes. They keep the track in gage, which spikes will not do, they lengthen the life of the the cross-ties, and hold the track in surface better. Rail chairs, which bolt or spike to the tie, and upon which the rail rests, are practically useless where traffic is heavy, as they will work and break and are a constant source of annoyance. The preservation of the gage is very important, and tie-plates will do this better than any other method. If put on every other tie they will hold the rail, but, if used on every tie, they will make a more solid and lasting piece of work. Joints should always be supported.

Many street railway men contend that the grooved rail requires four times as much tractive power as the side bearing head, owing to the tendency to hold dirt, snow and ice, and therefore is not as easily kept open to traffic. My experience has been that these rails are better finished, ride smoother, and are without trouble kept clean, free from snow and ice in winter, and no difficulty is encountered in trying to keep the road open for traffic.

It is now generally conceded that a harder quality of steel in the rails than is usually furnished is essential. None of the high-carbon rails on the New York Central Railroad near Spuyten Duyvil have broken after six years of unusually heavy traffic.

Steel inspectors say that high-carbon rails will give from 40 to 60 per cent. longer life than rails of ordinary Bessemer steel. To-day these rails cost no more than ordinary steel rails.

The composition of the rails should be as follows:

Carbon, from .53 to .63 per cent.; phosphorus, not to exceed .095 per cent.; sulphur, not to exceed .07 per cent.; manganese, .080 to .100 per cent.; silicon, .10 to .12 per cent.

In laying tracks be sure the joints are laid without open spaces between the ends of rails, no matter what the temperature is, and when in position bolt the splices up, driving them home with a hammer.

The prevailing practice of using such heavy rails is most costly and to our mind unnecessary. Were the joints given more attention the rails might be reduced to 66 lbs. per yard, instead of 80-95 lbs. In a 100 lb. rail there is but 30 lbs. of wearing surface, of which not more than 12 or 18 lbs. can be used before the rail will have to be thrown out; therefore there will be 88 to 82 lbs. unused. In Syracuse, rails are being now laid 60 ft. long, 9 in. high and of the half-groove section. They are connected by a ribbed or corrugated 12-bolt, 36-in. joint.

Chairs.—The less amount of chairs used the better, and their only necessity is to give the required height for the paving. An increased height in the web of rail will secure the same purpose, and much more effectively. A chair with a narrow base is apt to cut into the cross-tie, and in time work loose or cause the rail to cant.

The Milwaukee Electric Railway Company has thoroughly tested the Falk cast-welded rail joints, and the tests seem to indicate that bonding is not only absolutely unnecessary, but the joint actually proves a better conductor than the rail itself, as the resistance of the joint is less than the same length of the rail. The General Manager, Mr. C. D. Wyman, states that "by the results of these tests he feels sufficiently assured of its utility to continue the use of the cast-welded joint, without bonding, upon his system, believing ample margin is shown for any prospective deterioration likely to occur in the life of the joint underground." It makes an absolutely continuous rail of the track, and without the sign of a joint on the thread of the rail. It has withstood a temperature variation of from 100 deg. above zero to 24 deg. below zero.

Break joints at about one-third the length of the rails and better results will follow than by breaking in the center.

Bonds.—The method of testing the bonds is with a low-reading voltmeter, the connections being made by filing the rails on each side of the joint until a bright surface is obtained. As the current flowing through the joint is usually unknown, however, this method of testing is anything but satisfactory.

Paving.—Concrete is much preferred abroad for foundation to broken stone; in fact the latter is never allowed to be used. Where T-rails are used special bricks must be furnished of different lengths to lay next to the rails on the inside of the track, so as not to be in the way of the wheel flange, and forming a groove along the rail. Track drains are placed at intervals of 400 ft. and at points of break of grade. At Richmond, Va., the ties are bedded in concrete, while at Cortlandt, N. Y., the ties are laid underneath the concrete bed, and the rails rest on chairs placed upon the ties. This is not a good method of construction. In Washington, Buffalo, New York and Chicago asphalt pavement has been laid to a large extent. Its chief objection is the tendency to wear ruts along the rail and the spring of the rail loosens the pavement.

Curves.—In laying out the curves, the regular curvature is not carried through the entire length of curve. If it is, the change from the tangent or straight line to the curve is so abrupt that the wheels will strike the point of curve instead of traveling easily on to it. To avoid this, flatten the end, use a spiral, or ease off the curve.

Radius of curves should not be less than 35 ft. for cars with a 5-ft. wheel base, and double-track curves leaving a double track should not be struck from the same center.

Standards.—There should be a more thorough standardization of electric railroad apparatus. Definite rules should be fixed. Motors, generators, switches, circuit breakers, etc., should be precisely defined. This would abolish the different methods of rating electrical apparatus. Small and new roads suffer principally from this lack of standards, owing to not having skilled engineers. For example, notice the difference existing in defining the capacity of generators and motors. The varying features necessitated by the construction of motors for various characters of service offer great opportunities for mystery, and even the most efficient engineers are occasionally imposed upon by misused terms.

Power Plant.—The direct-coupled plant costs a little more than the direct-belted with independent engines, but enormously less than any plant based on large engines, with the attendant mass of counter shafting, clutch pulleys, belts, belt-tighteners, etc. Add to this the real estate and building item, and the chances are in favor of reducing the original investment one-half in an ordinary city plant. The relation of this fact to dividends is apparent. In constructing a plant, heavy losses accrue from misplaced material, which, being lost sight of, necessitates replacing. Although the tendency is in the direction of continuous current stations, perhaps direct currents are preferable, as they admit the employment of storage batteries, which equalize the load on the station. On large roads power costs about 10 per cent. of the operating expenses.

The cost of steam plants complete, including smoke stack and building is, for high speed and non condensing engines, from $45 to $60 per horse-power. For compound engines, $60 to $75 per horse-power, and for electrical equipment from $35 to $45 per horse-power. Eight square feet of heating surface, evaporating 30 lbs. of water per hour, is the usual limit of horse-power for sectional or water tube boilers, and 15 sq. ft. the unit for tubular boilers.

Boiler Room.—Water-tube boilers possess some marked advantages over the fire-tube. They are non-explosive, may be operated at a higher pressure and are more suitable for use with compound engines; they have a large heating surface and quickly respond to calls for power; they occupy less floor space and are better designed. They are more costly, more joints to be looked after, cleaning is more difficult, especially where curved tubes are used. Their efficiency is usually higher than fire tube, but they now make a fire-tube boiler, with a shell of large diameter and extra length, containing a large number of flues, which approaches the water tube very closely in efficiency.

Some companies are abandoning their chimneys for producing draft, and use an induced draft produced by fans placed in the flue or short stack, and the stack is just high enough to clear the roof. There is absolute control in governing the fires, which is an especial advantage where the loads are suddenly and rapidly changing. The boiler-room is supplied with blowers in place of stacks, and a slow fire is kept constantly under many boilers. When a call for power is expected, the blower is started and steam is quickly raised in sufficient quantity to supply any demand.

Engine-Room.—The upright engine requires less space than the horizontal, but the latter is the cheaper, the simpler, the easier to inspect and the easier to repair. The upright engine has less wear on the cylinder, and a more direct strain upon the foundations. Compound engines are usually installed now, but where condensers are not used the cost of fuel must be very high for the gain in compounding to pay for the extra investment.

The first cost of the direct coupled generator is about 35 per cent. more than the belted generator in the 500 K. W. size, which is the largest standard size in which the belted generator is made; but when the expense of the belt, belt-tightening device and the floor space is taken into account the direct connected generator will be found the cheaper. In large sizes and in connection with large engines it has a much higher efficiency than the belted unit, requires a smaller space, aids supervision by bringing the working parts of the engine and generator close together, reduces danger, is almost noiseless in operation, and it may be installed in a larger unit than the belt-driven generator, which is limited in size by the width of the belt and pulley which may be employed. The large, slow-speed multipolar, direct-driven generator has become the most prominent feature of the modern power-house. The switchboard has become standardized to the extent that it consists of a panel for each generator, each panel containing the usual automatic circuit breaker, ammeter, field rheostat, field

*Extracts from a paper by Mr. Edward Barrington read at the November meeting of the Western Society of Engineers.

switch and main switch. As now erected they usually contain a recording Watt meter and an ammeter which shows the total output of the power-house.

Boosters, or high voltage dynamos, are used by many companies operating long lines, which are constantly in circuit. It is automatic in its action and raises the voltage with every increase in the load. Other companies operate a high voltage dynamo for use on sections which are subject to excessive loads. The feeder boards in these cases are equipped with an extra bus-bar, so that any section may be throm on the high voltage machine.

Cost of Operation.—The lowest results are about ¾ cents per KW. hour; others run as high us 1¼ cents per KW. hour. These figures include the cost of coal, water, supplies, repairs and all labor, but do not include anything for taxes, insurance, interest or depreciation. The cost of operating depends largely on the price of coal and upon the relation of the average load to the total capacity of the power-house, the higher this ratio the less being the cost of operation.

Rolling Stock.—The four-wheel truck is an uncomfortable carriage and a track destroyer, and should only be used where cars are run at comparatively slow speed, and with moderate length of car bodies. At high rates of speed the damage to track becomes so great that its use should be precluded. By all means adopt the double truck car in such cases, with swivel or pivoted trucks; it is easy on curves, reduces weight on each wheel, is less destructive to the track, and there is no oscillation either way. There are, however, many objections to the pivotal truck. If all the weight is used for adhesion it is twice as expensive in use as the four-wheel truck. If two motors are used it only has 50 per cent. of the propelling power.

The motor should be mounted on the truck, so as to secure the greatest flexibility. The weight should be cushioned on the axle and truck by springs. This method of suspension tends to increase the life of the gears and pinions remarkably.

Flat wheels occasion much trouble, and they show a tendency to wear with a sharp flange on one side and a double flange on the other. Manganese steel wheels do not flatten, but they wear one to two inches in diameter in covering 20,000 miles. Chilled iron wheels weigh 360 lbs. each and average 3,000 miles in service per month. Pay the wheel makers more and secure a better wheel thus. The most reliable braking apparatus must be secured, regardless of cost. The air brake has been well developed and affords a high degree of protection. Electric heaters are very satisfactory, but it is claimed that they cost three times as much as stoves in operation. To offset this, stoves cost about $1.50 at the beginning of the season to put in shape for use.

Steep Grade Traction.—On steep grades heavy motors and series of parallel controllers are needed. The toothed armature cores, instead of smooth cores, and the protected field spools reduce the item of motor repairs, and a large share of the power formerly wasted at starting is saved by the new controllers. In San Francisco two 25-H. P. motors on each single-truck car are used on the very steep grades. Single-truck cars are preferred to double-truck cars, as they have more adhesion in proportion to the weight carried. The amount of power required to propel a car up a grade is independent of the speed. If the speed is low the force required is less, but the time during which it is exerted is longer. If the speed is rapid the force is greater and the time is less, so that the result is the same in either case.

Car Barn.—Further, much material now on the market is not by any means standard. I make no reflections on the manufacturers, but this is the fact, simply because the manufacturers do not understand the requirements of the business. Some may be unscrupulous enough to put goods on the market just for what is in them for awhile, regardless of their stability. There is a saving of 25 to 50 per cent. by manufacturing your own parts. Investigate the matter.

From the last census returns I cull the following interesting data relative to the cost of construction and cost of operating:

	Cable.	Electric.	Horse.
Cost of road and equipment per mile of line, street length	$350,324	$46,700	$71,400
Passengers carried per mile per year	1,355,965	222,648	596,563
Passengers carried per car mile	4.38	3.46	4.95
Operating expenses per car mile, cents	14.12	13.21	18.16
Interest charges per car mile, at assumed rate of 6 per cent., cents.	6.79	4.35	3.55
Sum of operating expenses and interest per car mile, cents	20.91	17.56	21.71
Operating expenses per passenger carried, cents	3.22	3.82	6 67
Interest charges per passenger, at assumed rate of 6 per cent., cents.	1.55	1.26	0.72
Sum of operating expense and interest per passenger carried, cents	4.77	5.08	4.39

On electric roads, the ratio of operating expenses to receipts is approximately 60 per cent. With horse cars the operating expenses are about 80 per cent. of the receipts. These figures are averages. Some are much lower and others considerably higher. For instance, in Chicago the ratio is about 40 per cent., while in Newcastle and Gosforth, England, it is 90.5 per cent.

The facts presented here are records of actual experience, and as such are believed to have considerable value, notwithstanding the unsatisfactory character of some of the conditions attending that experience.

Movable Dams on the Kanawha—The Pasqueau System.

For many years past the system of movable dams has been in successful operation on the internal waterways of France, Belgium and Holland, and since 1818 the American or "Bear Trap" dams have been used in this country. The first dams of the latter description were used on the Lehigh Navigation, under Josiah and Canvass White, but the length of the movable crest was not sufficient for modern commerce and modifications have been suggested from time to time, giving rise to the the Thénard shutter, 1828; the Poirée needle dam, 1833; the Fouracre shutters as used in India; the Chanoine wicket introduced in France about 1852; the Desfontaines drum wickets of 1864, used on the River Marne; the Cuvinot drum wickets; the Krantz pontoon wicket; the Carro or modified bear trap; the Girard shutter with hydraulic pistons; the Brunot gate or caisson; the counterpoised gate of Petitdidier; the device of Major King: the Janicke folding gate; the Haupt automatic pontoon gate; the Parsons hydraulic lock and gate, and many others.

But the requirements of coal tows on our Western rivers were and are such as to make a wide passage a necessity, so that a navigable pass of even 400 ft. in width, as proposed for the Davis Island dam, was regarded as a dangerous obstruction to the navigation of the Ohio, and exhaustive research was made to discover or devise some expedient whereby such dams could be operated without limit as to the width of opening. Fortunately, about this same time the construction of the La Mulatière dam, at the junction of the Soane and Rhone, required a pass of greater length than that found in the French practice, and the engineer in charge, M. Alfred Pasqueau, applied himself with great assiduity to the solution of this problem for several years. His labors were finally rewarded by a device which was at once so simple, cheap and efficient as to commend itself to the government for adoption. This ingenious invention consists of the introduction of a wedge-shaped piece of metal in front of the notch supporting the foot of the prop sustaining the wicket, so that when said wicket is drawn forward at the top the foot of the prop will be detached and thrown to the rear automatically, thus rendering each wicket independent of any shore connection and reducing the time of manœuvering the dam.

After a thorough investigation as to the merits and adaptability of this device the late Col. Wm. Merrill and Gen. Wm. P. Craighill, who has just retired from the office of Chief of Engineers, recommended its adoption for the Kanawha and Ohio dams, and it was extensively used in these works. To determine the validity of the American patents and the amount of the compensation to the inventor his claim was referred to the Court of Claims, where after about four years of litigation it was finally decided that he should receive the 100,000 francs which he had originally asked if settled without expenses of litigation. At this rate the award was less than the amount of money saved by the government in the construction of a single dam on the Ohio, and it amounted to $47.88 per "hurter." Since that date and during the continuation of the life of the patent, additional hurters have been introduced in dams Nos. 4, 5, 7 and 8 on the Great Kanawha, amounting to 383 hurters in all, for which a claim is now pending in the Court of Claims of the United States.

The remaining dams Nos. 9, 10 and 11, which are now under contract, and which will complete the improvement of the run to its junction with the Ohio, will also contain the Pasqueau hurters throughout, but as these contracts were let after the expiration of the life of the patent they have not been included in this claim.

TECHNICAL.

Manufacturing and Business.

The annual meeting of the Dickson Mfg. Co. was held at Scranton, Pa., last week, when the old Board of Directors was re-elected as follows: William Connell W. W. Scranton, C. S. Weston, C. C. Rose, W. H. Storrs, C. H. Zehnder, H. M. Boies, Samuel Sloan and C. R. Manville.

The Standard Railroad Signal Co., of Rahway, N. J., has just been awarded a contract by the Erie Railroad to put up interlocking switch and signal plants on its line at Owego, N. Y.; Avondale, N. J., and Kent, O.

The Critton Automatic Car Coupler Co., of Denver, Col., has been incorporated, with a capital stock of $1,250,000, by R. B. Critton, George W. Daniel and J. W. Thompson.

The annual meeting of the Union Switch & Signal Co., held at Pittsburg, Pa., March 9, resulted in the election of George Westinghouse, Jr., A. M. Byers, Thomas Rodd, James H. Willock and William McConway as directors for the ensuing year. A synopsis of the financial report, which was issued in advance of the meeting, appeared in our issue of Feb. 26. A supplementary statement was presented at the meeting, showing that all obligations of the company, except its bonds, which are not matured, have been paid off, and that the company is out of debt.

The works of the Jenney Electric Motor Co., at Indianapolis, Ind., were destroyed by fire at 2 o'clock on the morning of March 12. The loss to building, machinery and patents is estimated between $80,000 and $85,000. The company manufactured electric motors.

The stockholders of the Pancoast Ventilator Co., Bourse Building, Philadelphia, Pa., have been asked to authorize an increase in the capital stock from $50,000 to $100,000. The company reports a large increase in orders for its ventilators for both passenger cars and buildings.

The annual meeting of the St. Louis Car Wheel Co. was held at St. Louis, Mo., last week. John W. Nute, formerly General Agent of the company, was elected Secretary and Manager, to succeed R. W. Green, who resigned to engage in other business in St. Louis. The other officers are the same as last year.

The Berlin Iron Bridge Co., of East Berlin, Conn., is furnishing the steel work for the new foundry building of Theodore H. Colvin, at Providence, R. I. The building will be 102 ft. wide and 180 ft. long, and will be equipped with one 20-ton traveling crane and several 5-ton gib cranes. The entire framework of the building will be of steel.

J. S. Andrews has been appointed Chicago Agent for the Falls Hollow Staybolt Co., of Cuyahoga Falls, O., with office at 214 Royal Insurance Building, Chicago.

The Gates Iron Works, of Chicago, sends us a list of steam and street railroad companies that are using its crushers. The list includes 57 roads, which use in the aggregate 82 crushers.

John J. O'Brien & Co., of New York, have taken the contract for most of the work in connection with the extensive grade crossing improvement at Northampton, Mass. This work was begun last year and some of the changes have already been made. The tracks of both the New York, New Haven & Hartford and the Boston & Maine have to be elevated. The present contract includes about 20,000 yds. of filling, 40,000 yds. of excavation and 20,000 yds. of masonry. The new Union passenger station, to be built this year, is not included in this contract.

At the annual meeting of the St. Charles Car Co., held at St. Charles, Mo., last week, the newly elected Board of Directors met and re-elected officers as follows: President, W. G. Glasgow; Vice-President and General Manager, H. B. Denker; Assistant General Manager, C. W. Prosser; Secretary and Treasurer, Alph Aymond; Superintendent, J G. Lawler.

The Canadian Rand Drill Co., Sherbrooke, P. Que., has recently shipped to the Le Roi Mining Co., at Rossland, B. C., the largest air compressor ever been built in Canada. The engines are of the Corliss type, compound condensing. The two steam cylinders are 22 × 40 × 48 in. The two air cylinders are 22 in. and 34 in. in diameter. The crank shaft which drives the machine is 12 in. in diameter; the flywheel 10 ft. in diameter by 40-in. face. This is the third air compressor of the Rand make that the Le Roi mine is running. The capacity of the machine is forty drills. The mine at present is running about 28, all of the Rand Little Giant type.

The railroad spike mill of the Brown-Bonnell Iron Co., at Youngstown, O., is being operated on double time.

The Saline River Railroad is in the market for 300 tons of 25-lb. relaying rails. J. H. Draughon, of Draughon, Ark., is President.

The George V. Cresson Co., of Philadelphia, Pa., will soon commence work on an addition to its present plant. The new building will be of brick and iron, 40 × 130 ft., and will be used as a machine shop. The Berlin Iron Bridge Co., of East Berlin, Conn., has the contract.

The Manhattan Car Wheel Co., of New York City, has been incorporated with a capital stock of $10,000. The directors are: P. Henry Griffin, T. Guilford Smith, Charles V. Slocum and Warren P. King, of Buffalo, N. Y., and John A. Granger, of New York City.

The Lambert Hoisting Engine Co. has been organized under the laws of New Jersey to continue the business of the firm of W. A. Crook & Bros. Co., of Newark, N. J. The company will continue to manufacture hoisting engines especially adapted for railroad construction contractors, pile driving and bridge building. The company has offices at 143 Liberty street, New York City, and 47 Pearl street, Boston, Mass.

Henry F. Hill has been placed in charge of the New England territory of Chester B. Albree, of Allegheny, manufacturer of hydraulic, pneumatic and steam riveting machines. His office will be at 130 Oliver street, Boston, Mass.

The Shiffler Bridge Co., of Pittsburgh, Pa., has received a contract to erect three iron and steel buildings for the Michigan Alkali Co., at Wyandotte, Mich. The same company is also erecting for William Metcalf, at Braeburn, Pa., a new plant, the prodect of which will be crucible tool steel.

Iron and Steel.

The South Steel Mill of the Lackawanna Iron & Steel Co. at Scranton, Pa., shut down on March 13 for an indefinite period. The company's North Works are still running.

The stockholders of the Labelle Iron & Steel Co., Wheeling, W. Va., have decided to build another tin plate mill, to employ 300 men, and to cost $75,000. This company has a plant in operation of this size, and has not lost a day since last July.

Fire did $3,000 damage to the Norristown (Pa.) Tin Plate Work recently. The loss is covered by insurance.

The American Tin Plate Co. has begun the erection of a steel mill at Elwood, Pa., to cost about $100,000. It is expected that it will be completed by July 1. About 400 men will be employed, and the output of the works will be 400 tons of steel bars per day.

The Leechburg (Pa.) Foundry & Machine Co. is building an addition to its plant to cost $50,000. The improvement was made necessary by the increase in orders for rolls, the firm having sufficient orders to keep the works running for several months.

Furnaces Nos. 3 and 4 of the Carnegie Steel Co., Ltd., at Duquesne, Pa., are nearly completed and it is expected that they will be ready for blast by May 1.

New Stations and Shops.

An agreement has been made by the Missouri, Kansas & Texas with the citizens of Sedalia, Mo., by which the latter are to give the railroad 30 acres of land and $10,000 for the construction of new car shops, to cost not less than the sum mentioned. The site is about one mile west of that now occupied by the company's plant.

The Central Railroad of New Jersey has just awarded to A. Brower & Son, of Freehold, N. J., a contract to build of a freight station at that point, to cost about $2,500.

The Lehigh Valley proposes to build a new depot 102 × 26 ft. in size at Moravia, N. Y. It is proposed to complete the building by June 1.

The new shops of the Texas Midland at Terrell, Tex., are nearing completion. Machinery is being placed in position and a ravine is being filled to provide ground for extra side tracks which will intersect those already in position.

The Central of Georgia has accepted plans for a new depot at Savannah, Ga., to replace the one blown down in the storm of last September. A contract for its erection has been given and work will begin at once.

Work has been begun by the Chesapeake & Ohio on a new freight station and office building at Huntington, W. Va. The building is located at Second avenue and Ninth street, and will be of brick, two stories, and 60 × 110 ft. It is expected to complete it by August 1. The contractors are Starne & Maynard.

At the suggestion of the Southern road, Mr. Bradford L. Gilbert, of 50 Broadway, New York City, has prepared plans for a new union station at Atlanta. The plans contemplate a structure which will cost in the neighborhood of $300,000. The Southern has invested $150,000 in ground for a site at Mitchell street, and is ready to take up the building of the new station if the other roads should consider the matter favorably. The Atlanta City Council passed a resolution March 2 to the effect that the railroads must make a definite declaration of their purposes in the matter of a new union station within 60 days.

A Real Mono-Rail System.

Within the last few weeks *Engineering* (London) has described and illustrated a single-rail railroad, the invention of a French engineer, M. Caillet. The system is not intended for steam or other power traction, but is designed as a simple manner of assisting horse or manual traction where labor is scarce and roads are bad. The permanent way consists of sections of a light T-rail, to which are fastened at short distances flat sole plates. The rail sections are made of different weights, varying from 3 to 8 lbs. per foot, depending upon the service required The bed plates are rectangular, with stiffening flanges at the sides, and are fixed to the rails by two brackets riveted to each plate in such a way that the foot of the rail can be slipped through them. When the plates are turned at right angles to the rail, the brackets hold it firmly. The sole plates have holes through them so that they can be fastened by pins to the ground. The rail sections are joined by fish plates surrounding the base of the rail, in a manner to avoid the use of bolts. A light and simple form of stub switch is used for sidings and branches. The rolling stock of M. Caillet's railroad is carried on either two or four wheels grooved to fit the rail. The wheels run in bearings fixed to the light underframe of the car. The cars are of various forms, depending upon their intended use. They may be flat platform cars, ambulances, box wagons or trucks of various sorts. Projecting from one side of the cars propelled by hand power are one or two rods which the person handling the car takes a hold of to balance the vehicle and push it along. An ordinary type of hand car will carry a load of about 700 lbs. Attached to the side of the animal-propelled wagons is a light frame in which either one or two horses can be hitched. This arrangement is simple and serves to keep the car balanced and to propel it. One of these larger cars will carry from one to two tons. Supports hinged to the framework of the cars keep them in equilibrium while being loaded.

Bicycle Rack for Baggage Cars.

The Boston & Albany recently put a baggage car at the disposal of several inventors of devices for carrying bicycles for passengers. One of these was from Milwaukee, one from an employee of the Boston & Maine, and the "L. A. W." device, which is simple and compact. The wheels are stood on end, the front wheel at the bottom held in position by a U-shaped clamp screwed to the side of the car, while the upper or back wheel is held by a wire loop dropping over and past the center of the wheel, preventing it swaying with the motion of the car. A double row of wheels can be carried on one side of the car, the upper row hung from the roof of the car. In a space of about 8 ft. at one end of the car can be stored 10 wheels without interfering with each other, and any one of the ten can be delivered without disturbing the others.

Fire-Preventing Paint and Kalsomine.

The Atlantic Varnish Works, C. W. Tanner & Co. Proprietors, Richmond, Va., has sent us some sample pieces of wood, which have been coated with its fire preventing paint and kalsomine. The painted sticks have received two coats each and the kalsomined sticks one. The paint is just the same in appearance, in mode of application and in wearing properties as ordinary non-fire-proof paint, and it is said to cost no more. The kalsomine costs a little more than ordinary kalsomine, but it is furnished at a price that brings it within the reach of the largest consumers. It is intended for use on wood only. The paint may be used on either wood or iron. The maker claims that its paint and kalsomine prevent the spread of fire or retard it on naturally inflammable materials. The paint is composed of raw linseed oil and the usual white lead and pigments. The fire-preventing chemicals constitute about 14 per cent. of the bulk of the paint. They are so incorporated with the oil and the pigment as to be rendered thoroughly inert. As proof of this, the maker cites some work that has been standing four years, exposed to salt water, and has shown no signs of efflorescence, showing that in this time the chemicals have not left the paint by evaporation or otherwise. The paint and kalsomine are made in various colors, and are intended for use on the inside and outside of factories, warehouses, on shingled roofs, etc. The Richmond Locomotive & Machine Works has had the interior of its boiler shop painted with the paint about four years, and states that it has proved satisfactory. Mr. E. T. D. Myers, Jr., General Sales Agent for the United States, Richmond, Va., should be addressed for information.

Exports of Steel Tires and Steel-Tired Wheels.

In connection with the article in our issue of March 12 on Baldwin locomotives for China, it may be of interest to railroad men and manufactures to know that these locomotives will be equipped with tires and wheels of American manufacture. The Standard Steel Works will furnish all of this material, the engine truck wheels used being 36¼ in. and the tender truck wheels 42¼ in. outside diameter, all having forged wrought iron spoke centers of the Vauclain type. All of the locomotives built by the Baldwin Locomotive Works recently for Japan had tires and wheels manufactured by the Standard Steel Works, and this company is now at work on an order covering the tires for seven locomotives to be built for the Argentine Republic by a British locomotive works, this order being a duplicate of one filled last year for the same company. The orders for the tires and wheels for the 44 locomotives for the Japan Railway, covering 256 driving wheel tires and 546 engine and tender truck wheels, were received by the Standard Steel Works on Jan. 6, and all of the material was shipped by Feb. 20, and in addition to those 546 wheels for Japan, the Standard Steel Works in this same period, Jan. 6 to Feb. 20, shipped 300 additional wheels to American customers, as well as making their usual shipments of driving wheel tires.

Oscillation of a Tower.

Prof. W. Ritter gives in the *Schweizerische Bauzeitung* of Feb. 13 the results of his experiments on the oscillations of a tower in Zurich produced by the ringing of bells The tower, which is 39¼ meters high, contains five bells, ranging in weight from 425 to 3,430 kg., and it is remarkable that the light bells produced greater oscillations of the tower than the heavy ones. The horizontal oscillations were elliptical in shape and variable in size, those produced by a bell of 705 kg., which was swung 53 times per minute, being at a maximum 3.6 mm. long and 2.4 mm. wide, the longest axis being in the direction of the movement of the bell. When the five bells were rung at once the ellipse had a maximum major axis of 5.8 and a minor axis of 4.4 mm. The bells were swung from 43 to 57 times per minute, while the tower oscillated quite uniformly 160 times per minute. It was shown that the oscillations were felt at any point in the tower below the bells and that the amount of movement was proportional to the height above the ground. According to the principle of the conservation of center of gravity the tower tends to move in the opposite direction to that of the bell, and this movement increases until the resistance of the masonry produces equilibrium with the impulsive forces.

Tests of St. Louis Couplers.

We have recently received engravings showing some recent tests of the St. Louis coupler. One of them shows the guard arm test. The coupler endured three falls at 3 ft. and 25 at 5 ft. without a fracture, and it was still operative in all its parts. The total number of feet dropped was 134, the M. C. B. requirement being 24. The variation from the M. C. B. gage after this test was only about $\frac{1}{16}$ of an inch. Another engraving shows the lugs of the knuckle driven together with no fracture.

THE SCRAP HEAP.

Notes.

The Mexican Central is putting in quadruplex telegraph apparatus to be operated between the City of Mexico and Aguascalientes.

The engine-house of the Delaware River Railroad, together with three locomotives and other property, was burned down on the night of March 10; loss, $20,000.

A passenger train of the Louisville & Nashville was stopped by robbers near Calera, Ala., on the night of March 9, and about $3,000 taken out of the express car.

The bill before the New York Legislature to require the railroads to transport state officers free failed to pass. The vote was 75 to 48, and 76 votes were required to carry it through. Mr. Robbins, the chief objector to the bill, presented as one of his arguments Section 9, Article 10 of the Constitution, which says that state officers named in the Constitution must not receive any perquisite in addition to their salaries.

On the night of March 9 Mr. Robert Treat Paine traveled from Washington to Boston by special train in 11 hours 33 minutes, having started from Washington at 8:27 p. m. and reaching Boston at 8 o'clock the next morning. He made the trip to reach the bedside of his wife, who was ill, but she died before he reached her. The run over the Pennsylvania road, 227 miles, was made in 4 hours 45 minutes, about 20 minutes less than the schedule time of the fastest regular train. There was some delay in crossing the Hudson River and the trip across New York City was made in a carriage. Mr. Paine arrived at the Grand Central Station at 2:26 a. m. and started out at 2:28. The run to New Haven, 74 miles, was made in 1 hour 26 minutes.

A Connecticut editor who is traveling in Mexico writes home as follows: "One custom prevails on this road that the *Courant* has long urged for Connecticut. Wherever they kill a man they put up a black cross. You see them all along the road; here one, there three, at one spot are 14. Take Connecticut with its 1,100 grade crossings and its annual butcheries, and before long we would have such an array of crosses that the grade crossing would have to go. Here, no fence pens in the railroad. If anything is on the track, the engine removes it. A train hand told me that one trip, being late, they hurried, and in consequence killed three steers and five burros in eight hours. All along the track are skeletons stripped by the turkey buzzards and whitened by the sun."

Arguments for and against the proposed law prohibiting brokerage in tickets have been continued before the Legislative Committee at Albany, N. Y. Mr. Lansing, representative of the American Ticket Brokers' Association, stated that 95 per cent of the tickets handled by the members of his Association are sold to them directly by the railroad companies. Representatives of the printers' and other labor organizations spoke against the bill, asserting that the brokers had often aided the brotherhoods' needy members. A representative of the New York Hotel Men's Association favored the bill on the ground that if the scalpers were out of the way the railroads would make lower rates permitting conventions to be held in New York. Mr. Daniels, of the New York Central, repeated arguments heretofore presented, and said, among other things, that if the scalpers could be suppressed in New York state, it would break up the business throughout the country. The Federal anti-scalpers' bill, which passed the House, did not come to a vote in the Senate; but Mr. Sherman, the sponsor of it, says it will be pressed in the 55th Congress.

Street Railroad Earnings.

The *Financial Chronicle* gives the following figures as the earnings of street railroads for the year ending Dec. 31, 1896: The gross earnings of all the roads of New York City last year was $23,390,000; Boston, $9,763,000; Philadelphia, $10,787,000; Baltimore, $2,702,000; Chicago, $14,900,000; Pittsburg, $3,911,000; St. Louis, $2,209,000; Cleveland, $2,795,000; New Orleans, $1,334,000; Kansas City $1,773,000; Minneapolis and St. Paul, $2,057,000; Buffalo, $1,884,000; Rochester, $889,000; Detroit, $1,704,000; Denver, $724,000; Des Moines, $240,000; Louisville, $1,235,000; Galveston, $213,000; New Haven, $809,000; Hartford, $637,000; Worcester, $636, 000.

Coal Production in Alabama.

The coal and coke and iron outputs of Alabama for 1896 are reported to be greater than that for 1895, which was the best in the history of the state. The increase is accounted for by an extension of trade territory, especially in iron exports to the Old World. State Mine Inspector Hillhouse reports: Total coal output for 1896, 5,731,738 tons, an increase over 1895 of 26,025 tons; total coke product, 2,589,740 tons, an increase of over 800,000 tons.

Two Ancient Locomotives.

The locomotive "Invicta," is to be permanently placed on exhibition at the Charing Cross Station of the South-Eastern Railway, London, and will thus occupy a place of honor similar to that of "Puffing Billy" on the Newcastle High Level Bridge, and the locomotive at Darlington Station. The "Invicta" was the first engine run on the pioneer Kentish Railway—the Canterbury & Whitstable. That line was opened on May 3, 1830. The locomotive, the only one the company had in those days, was built by Stephenson & Co. Its cylinders were 10 in. diameter, stroke 18 in., boiler 10 ft. long, pressure 40 lbs. per square inch, and the wheels were 4 ft. diameter.

The Great Western directors have presented the first Great Western engine, the "North Star," to the South Kensington Museum. The "North Star" was constructed by R. Stephenson & Co., and delivered to the Great Western in 1837. It was a distinct advance upon the "Invicta," the "Comet," the "Vulcan," and the "Swiftsure" of an earlier day. It was No. 1 in the books of the railroad company, and No. 150 in those of the makers. From the evidence of Mr. Stephenson and Mr. Brunel before the Royal Commision appointed to investigate the gage question, this engine was built for a railroad in America, but was never delivered. It ran its first trip on January 1, 1838, and began its daily work when the line was opened to Maidenhead on June 4 in that year. During the thirty-two years it was at work it ran a distance of 429,000 miles.

Long Distance Electrical Transmission.

Mr. John J. Seymour, President of the San Joaquin Electric Company, which operates the San Joaquin River-Fresno long-distance transmission plant, writes to the General Electric Co. as follows: "The entire plant has been in actual practical operation for several months. The 35 miles transmission has given us no trouble whatever. Our load at present consists of 145 arc lights and 5,000 incandescent lights, and 410 H. P. in motors, the latter including 180 H. P. for the Sperry flour mill and 75 H. P. for the city pumping plant. All of the machinery doing this work has worked with perfect success from the start. The incandescent lights have most of them been newly wired in, thus enabling us to properly balance the load, and the regulation has given us no trouble whatever. During extensive tests it was impossible to find more than two volts variation between any lamps on the system."

LOCOMOTIVE BUILDING.

The Houston & Texas Central is reported in the market for five locomotives.

The Lake Shore & Michigan Southern is in the market for five switching engines.

Lane Bros. & Co., Scottsville, Pa., want a medium sized narrow-gage locomotive, either new or second-hand.

The Saline River Railroad is in the market for a 25-ton locomotive. The road was incorporated in Arkansas Jan. 21, 1897. J. H. Draughon, of Draughon, Ark., is President.

There is no truth in the report published by a contemporary that the Erie Railroad has placed an order with the Baldwin Locomotive Works for seven new eight-wheel engines.

The Mexican Central has just placed an order with the Brooks Locomotive Works for 21 10-wheel simple engines, referred to in our issue of March 5. They will have 20 × 24 in. cylinders, 60 in. drivers, special Taylor driving wheel axles, Krupp tires and Belpaire boilers.

The Baldwin Locomotive Works recently received orders for building the following engines: One 10-wheeler, Spokane Falls & Northern Railroad; two moguls, Sierra Madre Construction Co. for Rio Grande, Sierra Madre & Pacific Railroad; and one locomotive for the New York, Chicago & St. Louis.

The Southern Pacific has received the five 10-wheel freight engines ordered from the Schenectady Locomotive Works, as noted in our issue of Jan. 8. The engines have cylinders 20 × 26 in., 64-in. drivers, 62-in. boiler with about 275 2 in. flues. Capacity of the tender tank is 4,000 gals., and the entire weight of the locomotive in running order is 252,000 lbs.

The Erie Railroad has contracted with the Rogers Locomotive Co., of Paterson, N. J., for 24 Wootten boilers to be delivered at the rate of two a month. These will be applied to old Class I locomotives, in place of old boilers. The new boilers will be 60 in. in diameter at front end, have 214 2-in. flues 11 ft. long, and be equipped with combustion chambers. With these boilers the company can burn culm.

CAR BUILDING.

The Pennsylvania Company is in the market for 200 cars.

The Pittsburgh & Lake Erie is in the market for 1,000 cars.

The St Louis, Vandalia & Terre Haute is in the market for 175 cars.

The Boston & Maine expects to shortly put on its line an instruction car, work on which is about completed.

Lane Bros. & Co., of Scottsville, Pa., are in market for 30 3-ft. gage contractors' dump cars, of 3 yds. capacity.

The Mexican Central has just awarded a contract to the Michigan-Peninsular Car Co. for building 635 freight cars.

The Baltimore & Ohio has placed an order with the Pullman Palace Car Co. for a large number of freight cars. The number is stated to be 3,000.

It is believed that the order of the Pittsburgh, Bessemer & Lake Erie for steel cars (specifications of which appeared in our issue of March 5) will be 600.

The Mobile Street Railway Co. has just built at its shops in Mobile, Ala., a new passenger car, after designs by J. F. McAviney, Chief Engineer and Electrician of the road. It is an open car with vestibules.

Thomas P. Ivy, of Atlanta, Ga., informs us that a freight motor, two passenger and probably two freight cars will be required for a new electric road to be built from and through Gainesville, Ga., to the Chattahoochee River.

The Newburyport Car Co., of Newburyport, Mass., has received an order from the Brockton, Bridgewater & Taunton Electric Street Railroad for 20 cars. A number of these will be open passenger cars and the balance freight cars.

The Rockland, Thomaston & Camden Street Railway Co. (Maine) is having built a new combination summer and winter passenger car, 34 ft. long, with a seating capacity for 40 persons. It will be equipped with the Robinson radial truck and G. E. 1,000 motor.

BRIDGE BUILDING.

Belleville, Ont.—A new bridge across the Moira River is proposed, costing about $7,000.

Boston, Mass.—The Commissioners appointed by the Suffolk Superior Court to determine the manner of abolishing the Congress street grade crossing on the New England, have filed their report in court. It is proposed to discontinue Congress street across the railroad tracks, and to build a new street, 100 ft. wide, connecting Summer street, as extended, with L street bridge, South Boston, by means of a double drawbridge at Fort Point channel, and a suspension bridge over the railroad tracks. The city is to do the work, except the building of the bridge, which is to be done by the railroad.

Butler, Pa.—The Grand Jury of this county calls the Court's attention to their having inspected the bridge on South Main street, which they consider unsafe, and recommend that the bridge be made wider and a walk be placed on each side not less than 4 ft. wide.

Gaston, N. C.—The completion of the Virginia & Carolina from Petersburg, Va., to this place will involve the building of an iron and steel bridge across the Roanoke River at this point. Little stonework will be required, as the pillars for the bridge, built some years ago by the company, which then contemplated the completion of the road, are still standing in good condition, and can be utilized now, with some finishing touches.

Indianapolis, Ind.—The Board of Works has referred to the City Engineer the petition for a bridge over Fall Creek at Senate avenue. The Meridian street bridge is congested with traffic. The petitioners therefore urge that a necessity exists for the bridge for which they ask.

London, Ont.—The Grand Trunk will rebuild a number of bridges between London and Windsor, Ont. These bridges will be of iron, with solid masonry abutments. Bridge Inspector Lucas has plans for five of the proposed bridges on view at his office here.

New York.—The bill allowing the temporary Macomb's Dam bridge to remain for five years for use by railroad companies has been amended so that should the Commissioners of the Department of Public Parks deem it necessary to allow the temporary bridge to remain, they are authorized to build a temporary structure connecting the easterly end of 145th street with the westerly end of 149th street and to build necessary approaches thereto; $150,000 shall be applied to the erection of such temporory structure and the construction of approaohes instead of to the removal of the temporary bridge now at Seventh avenue.

A bill has been introduced at Albany authorizing this city to expend $150,000 for the construction of a bridge over the New York Central and New York & Putnam tracks at Fort Independence street.

Ottawa, Ont.—The City Engineer has examined the plans for a new bridge across Maria street. These plans were made a year ago and are for a steel bridge at a cost of $45,000.

Pittsburgh, Pa.—A charter was issued to the Pittsburgh & Sharpsburgh Bridge Co. March 15. The directors are: Gustav Kauffman, Albert L. Schultz, Otto G. Schultz, Edward H. Sapp, Wm. Kauffman. The bridge will span the Allegheny River between Butler street, this city, and Sharpsburg.

St. Louis, Mo.—The Mayor has signed the Clark avenue bridge bill. It is understood that designs will be prepared and bids solicited for the erection of a single stone pier. The Terminal Railroad Association pays $150,000 toward the bridge in return for the privilege of erecting union station.

Scranton, Pa.—The resolution introduced in Councils directing the City Engineer to prepare a plan and estimate of the cost of a bridge over the D., L. & W. tracks from Clover street to Iron street in the North End has been adopted.

Wilmington, Del.—The Street and Sewer Department and the Baltimore & Ohio have arrived at an agreement in regard to the abolishment of all grade crossings along the railroad through the city. The agreement as it now stands calls for the construction of five bridges in the city, one to be built each year, unless by mutual agreement more than one is built every 12 months. Six iron bridges in all will be built, and five of these will be new. The wooden bridge at Seventh street will be replaced by an iron structure, and work on it has already commenced. The work will be done at the expense of the railroad.

York, Pa.—The city ordinance which vacates a portion of West College avenue, to allow for the approach to the new $50,000 overhead bridge crossing the Northern Central tracks and Codorus Creek, on that street, has been adopted.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Chicago Junction Railway & Union Stock Yards Co., 1¾ per cent. on preferred stock, payable April 1.

Chicago, Milwaukee & St. Paul, 2 per cent. on common stock and 3½ per cent. on preferred stock, both payable April 19

Chicago & Northwestern, quarterly, 1¾ per cent. on preferred stock, payable April 6.

New York & Harlem, 2 per cent. on preferred stock, payable April 1.

New York Central & Hudson River, quarterly, 1 per cent, payable April 15.

New York, New Haven & Hartford, quarterly, 2 per cent., payable March 31.

Norfolk & Southern, quarterly, 1 per cent., payable April 10.

Northern of New Hampshire, quarterly, 1½ per cent. and extra dividend of 2 per cent., both payable April 1.

Northwestern, quarterly, 1¾ per cent. on preferred stock, payable April 6.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Catawissa, annual, 237 South Third street, Philadelphia, April 6.

Chicago & Alton, annual, Chicago, Ill., April 5.

Joliet & Chicago, annual, Chicago, Ill., April 5.

Lake Shore & Michigan Southern, special, Cleveland, O., and Erie, Pa., May 20.

Panama, annual, 29 Broadway, New York, April 1.

Pittsburgh, Cincinnati, Chicago & St. Louis, annual, Pen avenue and Tenth street, Pittsburgh, Pa., April 13.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Street Railway Accountants' Association* will meet to organize in Cleveland, O., March 23 and 24, 1897. For further particulars see issue of Feb. 12, page 121, and for programme see next column.

The *American Railway Association* will hold its convention at Richmond, Va., on April 7, 1897.

The *National Convention of Railroad Commissioners* will be held at St. Louis, Mo., on May 11, 1897.

The *Association of Railroad Claim Agents* will hold their next meeting at the Southern Hotel, St. Louis, May 26, 1897.

The *Association of American Railway Accounting Officers* will hold a convention at Richmond, Va., on May 26, 1897.

The *Association of Railway Claim Agents* will hold its convention at St. Louis, Mo., during the last week of May, 1897.

The *Master Car Builders' Association* will hold its annual convention at Old Point Comfort, Va., beginning June 8, 1897.

The *American Railway Master Mechanics' Association* will hold its annual convention at Old Point Comfort, Va., beginning June 15, 1897.

The *National Association of Local Freight Agents' Associations* will hold a convention at Washington, D. C., on June 8, 1897.

The *Association of Railway Telegraph Superintendents* will hold a convention at Niagara Falls, N. Y., on June 16, 1897.

The *National Association of Car Service Managers* will hold a convention at Boston, Mass., on June 16, 1897.

The *Train Despatchers' Association of America* will hold a convention at Detroit, Mich., on June 22, 1897.

The *Railway Signalling Club* will meet on the second Tuesday of the months of January, March, May, September and November, in Chicago.

The *Western Railway Club* meets in Chicago on the third Tuesday of each month, at 2 p m.

The *New York Railroad Club* meets at 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The *New England Railroad Club* meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Tuesday of each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, N. Y., on the second Friday of January, March, May, September and November, at 2 p. m.

The *Southern and Southwestern Railway Club* meets at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November.

The *North-West Railway Club* meets on the first Tuesday after the second Monday in each month, at 8 p. m., the place of meeting alternating between the West Hotel, Minneapolis, and the Ryan Hotel, St. Paul.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2.30 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month, at 8 p. m.

The *Western Society of Engineers* meets in its rooms on the first Wednesday of each month, at 8 p. m., to hear reports, and for the reading and discussion of papers. The headquarters of the Society are at 1736–1739 Monadnock Block, Chicago.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m., except during July and August.

The *Denver Society of Civil Engineers* meets at 3 Jacobson Block, Denver, Col., on the second Tuesday of each month except during July and August.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday, at 8 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the room of the Literary Club, No. 25 East Eighth street, Cincinnati, O., on the third Thursday in each month, at 7:30 p. m. Address P. O. Box 333.

The *Engineers' and Architects' Club of Louisville* meets in the Norton Building, Fourth avenue and Jefferson street, on the second Thursday each month at 8 p. m.

The *Western Foundrymen's Association* meets in the Great Northern Hotel, Chicago, on the third Wednesday of each month. S. T. Johnston, Monadnock Block, Chicago, is secretary.

The *Engineers' Club of Columbus, (O.)*, meets at 12½ North High street, on the first and third Saturdays from September to June.

The *Engineers' and Architects' Association of Southern California* meets each third Wednesday of the month in the Hall of the Chamber of Commerce, Los Angeles, Cal.

The *Engineers' Society of Western New York* holds regular meetings the first Monday in each month, except in the months of July and August, at the Buffalo Library Building.

The *Civil Engineers' Society of St. Paul* meets on the first Monday of each month, except June, July, August and September.

The *Engineers' Society of Western New York* meets on the first Monday of each month at the Society's rooms in the Buffalo Library.

The *Boston Society of Civil Engineers* meets at 715 Tremont Temple, Boston, on the third Wednesday in each month, at 7:30 p. m.

The *Engineers' Club of St. Louis* meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas place, St. Louis, on the first and third Wednesdays in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Engineers' Society of Western Pennsylvania* meets at 410 Penn avenue, Pittsburgh, Pa., on the third Tuesday in each month, at 7:30 p. m.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Association of Engineers of Virginia* holds informal meetings on the third Wednesday of each month from September to May, inclusive, at 710 Terry Building Roanoke, at 8 p. m.

Western Society of Engineers.

The next meeting of the Western Society of Engineers will be held Wednesday evening, March 24. Mr. Clement F. Street will read a paper on "Railway Ties in India."

Ticket Agents' Association.

The seventh annual meeting of the International Association of Ticket Agents was held at San Antonio, Tex., March 10. About 150 members and their wives were present. Officers were elected as follows: President, Charles C Benson, Lewiston, Me.; First Vice-President, Charles Van Kampen, Rochester, Minn.; Second Vice-President, E. V. Bland, Buffalo; Third Vice-President, J. A. Robbins, Chicago; Secretary, C. C. Cadwallader, Philadelphia; Treasurer, Elwood Ramsey, Philadelphia.

Western Railway Club.

A meeting of the Western Railway Club was held Tuesday, March 16, at the Auditorium Hotel, Chicago. The paper presented at the February meeting by Mr. C. H. Quereau, on "Lead for Locomotives," was discussed, and also the subject "Long versus Short Locomotive Runs." The committee appointed to consider the revision of the Interchange Rules presented a report. The following papers were read: "Car and Locomotive Lubrication," by Mr. George W. Cushing; "Specifications for Malleable Cast Iron," by Mr. C. L. Sullivan.

Civil Engineers' Club of Cleveland.

The annual meeting of the club was held at Cleveland, March 9. The annual reports of the retiring officers showed the finances of the club to be in excellent condition, and the membership to have increased to a total of 191, a net gain of 28 members for the year. The retiring President delivered an address on "The Early History of Instruments, and the Art of Observing in Astronomy and Civil Engineering." The following officers were elected for the ensuing year: President, James Ritchie; Vice-President, C. M. Barber; Secretary, F. A. Coburn; Treasurer, Hiram Kimball; Librarian, A. Lincoln Hyde; First Director, John W. Langley; Second Director, Wm. C. Jewett. After a few remarks by President-elect Ritchie the meeting adjourned.

Central Railway Club.

A regular meeting of the Central Railway Club was held on Friday afternoon, March 12, at the Hotel Iroquois, Buffalo, N. Y. The following papers were submitted: "Brick Arches in Locomotive Fireboxes," Committee, F. B. Griffith, George Hazelton, E. P. Mooney, A. E. Mitchell, George W. West; "Piece Work in Car Repairs," Committee, H. C. McCarty, Thomas Anderson, John S. Lentz, J. R. Petrie, Robert Gunn; a non-debatable paper on "Electricity," F. B. Griffith; memorial to the late Willard G. Taber, Committee, P. E. Garrison, Amos Gould, J. N. Weaver; General discussion—"Apprentice Boys in Machine-shops."

The subjects and committees for the next meeting of the club to be held in May are as follows: Revision of the Rules of Interchange Committee, H. F. Ball, R. S. Miller, E. D. Bronner, Allan Vail, J. R. Petrie. "Steel Shapes for Trucks; best method—rolled or pressed?" H. H. Hewitt, James B. Brady, C. T. Shoen, John W. Cloud.

Street Railway Accountants.

As already announced, the street railroad accountants

will meet at the Hollenden Hotel, Cleveland, O., March 23 and 24, to form a permanent organization, the regular meeting of which will hereafter be held at the same date and in the same city as the American Street Railway Association. The delegates are urged to bring complete sets of forms and blanks for exchange and inspection. The following papers will be presented and discussed at the meeting:

"From Horse to Electric Accounts," by H. L. Wilson, Auditor West End Street Railroad, Boston; "Useful and Useless Classifications," by E. D. Hibbs, Auditor Consolidated Traction Co., Jersey City; "Suggestions for a Standard System of Accounts; Classification of Operating Expense Accounts, and Form of Report that will Admit of Comparison and Diffuse Information between Companies," by C. N. Duffy, Secretary and Treasurer Citizens' Railway, St. Louis; "Earnings: Handling and Accounting," by John Hourigan, Auditor Albany Railway Co., Albany, N. Y.; "Monthly Closing of Accounts," by Dana Stevens, Accountant for Receiver, Belt Railway, Washington, D. C.; "Transfer Tickets," by Frank R. Greene, Secretary Chicago City Railway; "The Relation of Accountants to Managers and Employees," by P. V. Burington, Secretary and Auditor Columbus Street Railway; "A Simple System of Interurban Accounts," by W. B. Brockway, Auditor Bowling Green & Fremont Railway; "Naming and Standardizing Apparatus," by J. P. E. Clark, General Manager Binghamton Railroad Co.; "Depreciation," by H. C. McJilton, Auditor Baltimore Traction Co. For general discussion: "Statistical Reports in a Nutshell," "Some Ways We Can Simplify Accounts," "Standardizing Accounts."

At 2 p. m. Wednesday the street railroad companies of Cleveland will give the guests a trolley excursion.

PERSONAL.

—Mr. P. L. Williams has been appointed General Attorney for the Oregon Short Line.

—Mr. T. J. Scott has been appointed Division Freight Agent of the Toledo, St. Louis & Kansas City.

—Mr. K. H. Wade, General Manager of the Southern California, died suddenly at Los Angeles, Cal., on March 12

—Mr. C. H. Dent has been appointed General Agent of the Missouri, Kansas & Texas, with headquarters at St. Louis, Mo.

—Mr. S. P. Peabody, General Agent of the Baltimore & Ohio, at Columbus, O., has resigned and the office has been abolished.

—Mr. William R. Van Valen has been appointed General Agent of the Chicago, St. Paul, Minneapolis & Omaha at Sioux City, Ia.

—Dr. R. B. Crawford has been appointed Traveling Passenger Agent of the Louisville & Nashville, with headquarters in Chicago.

—Mr. T. C. Clifford has been appointed Superintendent of the Dining Car Service of the Erie. The appointment took effect March 15.

—Mr. George W. Dewees has been appointed General Baggage Agent of the South Carolina & Georgia, to succeed P. D. Mazyck, deceased.

—Mr. George Jerome, at one time General Counsel for the Detroit, Grand Haven & Milwaukee, died at his home in Detroit, Mich., on March 6.

—Mr. M. W. Joyce, General Agent of the Atchison, Topeka & Santa Fe, at New Orleans, La., died at his home in that city, on March 6.

—Mr. R. H. Barnes has been appointed Southern Passenger Agent of the Kansas City, Pittsburgh & Gulf, with headquarters at Shreveport, La.

—Mr. G. A. Croft has been elected Vice-President and Contracting Agent of the Wadley & Mt. Vernon Railroad, with headquarters at Atlanta, Ga.

—Mr. John S. Dennee has been appointed Freight and Passenger Agent at New Orleans, La., of the Union Pacific, and the Fort Worth & Denver City.

—Mr. E. E. Russell Tratman, Associate Editor of *Engineering News*, will be married in New York, March 29, to the daughter of Mrs. A. M. Radcliffe of that city.

—Mr. H. S. Creighton, formerly Acting Auditor of the Maricopa & Phœnix & Salt River Valley, has been appointed Auditor, with headquarters at Phœnix, Ariz.

—Mr. W. W. Huntington has been appointed General Auditor of the Duluth, Missabe & Northern, with headquarters in New York City, to succeed Mr. G. N. Naylor.

—Gen. George J. Magee, President of the Fall Brook Railroad, died at Nice, France, on March 11. General Magee was making a trip for his health at the time of his death.

—Col. Alexander E. Drake, a retired army officer, died at his home in Philadelphia on March 13. In 1850 Col. Drake was an Assistant Engineer on the Southern Pacific Railroad.

—Mr. R. S. Kayler, of Alliance, O., has been appointed Commissioner of Railroads and Telegraphs of the State of Ohio, by Governor Bushnell, to succeed Mr. William Kirkby, whose term has expired.

—Mr. C. O. Johnston has been appointed General Agent of the Chicago Great Western, with headquarters at San Francisco. Mr. Johnston will have jurisdiction over California, Nevada and Arizona.

—Mr. W. W. Walker has been appointed Assistant General Freight Agent of the Duluth, South Shore & Atlantic, the Duluth, Superior & Western, the Mineral Range and the Hancock & Calumet Railroads, with headquarters at Duluth, Minn.

—Mr. E. E. Smythe, formerly Commercial Agent of the Kansas City, Fort Scott & Memphis, at Springfield, Mo., has been appointed Assistant General Freight Agent of the Kansas City, Pittsburgh & Gulf, with headquarters at Kansas City, Mo.

—Col. J. C. Clarke, President of the Mobile & Ohio Railroad, was re-elected at a recent meeting of the directors, and was granted a year's leave of absence, which time he will spend in the West. Colonel Clarke has been in poor health for some time.

—Mr. W. Walmsley has been appointed Superintendent of the South Chicago City Railways; he succeeds Mr. D. J. Jones, who has resigned, to engage in business with J. M. Atkinson & Co., Chicago, who manufacture the "horseshoe rail bond," Mr. Jones' present.

—Mr. D. A. Bender, formerly Secretary and General Freight and Passenger Agent of the Carson & Colorado, and General Freight and Passenger Agent of the Virginia & Truckee railroads, has been appointed Assistant General Manager of the Alameda & San Joaquin Railroad.

—Mr. W. J. Murphy, Superintendent of the Cincinnati, New Orleans & Texas Pacific at Lexington, Ky., delivered a lecture the other night before the Mechanical Engineering Society of the Kentucky State College on the duties and responsibilities of a railroad superintendent.

—Mr. Arthur J. Giddings, formerly Chief Clerk of the Nickel Plate Fast Freight Line, has been appointed Western Agent of the company, with headquarters at Denver, Col. Mr. Giddings will have charge of all territory west of the Missouri River. The appointment will take effect on April 1.

—Mr. J. D. Sadler, formerly Contracting Freight Agent of the Texas & Pacific at New Orleans, La., has been appointed District Freight Agent of the company with headquarters at New Orleans. Mr. Sadler has been succeeded as Contracting Freight Agent by his brother, Thomas Sadler.

—Mr. D. T. McCabe, formerly General Freight Agent at Columbus, O., of the Southwest System of the Pennsylvania lines west of Pittsburgh, has been appointed Freight Traffic Manager of the company to succeed Mr. William Stewart, resigned. Mr. McCabe has been succeeded by Mr. J. B. Hill, formerly General Western and Division Freight Agent of the Southwest System at Chicago.

—Mr. William H. Blood, until recently General Superintendent of the Long Island Railroad, has been appointed Superintendent of the Eastern Division of the Brooklyn Heights Railroad, succeeding Mr. R. J. Bryers, who has been appointed Superintendent of Trucks. The Brooklyn Heights road operates more than 200 miles of trolley electric road in the city of Brooklyn, N. Y., and its officers are all experienced steam railroad men.

—Mr. Thomas A. Meryweather died at his home in Philadelphia, Pa., on March 8. Mr. Meryweather entered the employ of the Pennsylvania Railroad in 1883 as Assistant Engineer, remaining with the company for 10 years. He had charge of the construction of the Trenton Cut-off Branch. Mr. Meryweather also superintended the construction of the Roxborough, Chestnut Hill & Norristown Traction Co.'s electric road and was an assistant engineer under Gen. Russell Thayer, superintending the construction of the electric line in West Fairmont Park, Philadelphia.

—Mr. Katsutaro Inuzuka, Secretary of the Imperial Railway Bureau and Councillor of the Department of Communications, of Japan, has been making a tour of the United States, investigating the organization and the legal departments of some of the principal roads. Mr. Inuzuka arrived in Vancouver on Feb 11 and has visited San Francisco, Chicago, Washington, Philadelphia and New York. He sailed from this city on the American line steamer Paris, March 17, and will visit England and the continent, examining the methods of the railroads of those countries.

ELECTIONS AND APPOINTMENTS.

Atlanta & Charlotte Air Line.—At a meeting of stockholders held on March 10, the present Board of Directors was re-elected. The directors then elected officers as follows: President, Charles S. Fairchild; Secretary, William N. Wilmer; Treasurer, George Sherman.

Bruton & Pineora.—Officers of this road, formerly the Atlantic Short Line, were recently elected as follows: President, A. F. Daly; Vice-President, George Perkins; Secretary, M. P. Lane. The above, with Messrs. John R. Young and Henry D. Stevens, constitute the Board of Directors.

Buffalo & Susquehanna.—William C. Park, formerly Roadmaster, has been appointed Superintendent with headquarters at Austin, Pa., in charge of about 120 miles of main line.

Chicago, Burlington & Quincy.—The directors have elected officers as follows: President, C. E. Perkins; Vice-President and Treasurer, J. C. Peasley; Second Vice-President, George B. Harris; Secretary, W. J. Ladd. Mr. Ladd, who was formerly Comptroller, succeeds T. S. Howland.

Chicago, Rock Island & Pacific.—John Gill, General Foreman at Horton, Kan., has been appointed Master Mechanic of the Illinois Division, with headquarters at Chicago. The appointment took effect March 15.

Columbus, Hocking Valley & Toledo.—At the annual meeting of stockholders, held in Columbus, O., on March 16, Calvin S. Brice, P. W. Huntington and James Kilbourne were re-elected directors for three years.

Erie.—T. H. Pendell has been appointed Superintendent of the Greenwood Lake Division, the Caldwell Branch, the Orange Branch and the Northern Railroad of New Jersey, with headquarters in Jersey City, N. J., to succeed B. E. Moodey, resigned.

Erie Eastern.—The directors of this company, recently chartered at Harrisburg, to build a railroad in Pennsylvania, are: Lloyd G. Reed, Edward J. Howard, Thomas Paskett, Christian Kessler, Thomas A. Robinson, J. R. Brotheton, A. A. Freeman, A. J. J. Roemer, Edward Hener and J. M. Sherwin, all of Erie, Pa., and John A. Boland, of Waterford, and E. E. Humes, of Cambridgeboro.

Great Northern.—James Russell, formerly Chief Dispatcher of the Dakota Division, has been appointed Superintendent of the Willmar Division, with headquarters at Minneapolis, Minn., succeeding P. L. Clarity, resigned. L. L. Hiller has been appointed Chief Dispatcher of the Dakota Division, with headquarters at Laramie, N. Dak., to succeed Mr. Russell.

Green Bay & Western.—At the stockholders' annual meeting, held at Green Bay, Wis., March 11, the following Directors were elected: S. S. Palmer, M. T. Cox, William J. Hunt, C. Ledyard Blair, of New York; J. Jordan, of Hannibal. Mr. Jordan succeeds W. J. Wilson. S. S. Palmer was re-elected President and Mark T. Cox Secretary and Treasurer.

Kansas City, Shreveport & Gulf.—The Directors have elected the following officers: President, A. E. Stilwell; First Vice-President, Simon Levy, Jr.; Second Vice-President, W. S. Taylor; Secretary and Treasurer, F. S. Hammond.

Missouri, Kansas & Texas.—At a meeting of the Executive Committee of the Board of Directors on March 9 Darius Miller, Traffic Manager, with headquarters at St. Louis, was appointed Vice President in charge of the traffic department. Mr. Miller retains his title of Traffic Manager.

Missouri Pacific.—At the annual meeting of the stockholders, on March 9, the present Board of Directors was re-elected.

Mobile & Ohio.—In consequence of President J. C. Clark having been granted a year's leave of absence, the office of First Vice-President has been created, E. L. Russell having been appointed to that position. Mr. Russell will discharge the duties of President during Mr. Clark's absence.

New York, Philadelphia & Norfolk.—At the annual meeting of the directors, held in Cape Charles, Va., on March 16, the following officers were re-elected: President, A. J. Cassatt; Vice-President, William A. Patton; Treasurer, J. G. Cassatt.

Oregon Short Line.—H. E. Van Housen has been appointed Superintendent of the Idaho Division, with headquarters at Pocatello, Idaho, and J. H. Young, Superintendent of the Utah Division, with headquarters at Salt Lake City. Both appointments took effect March 16.

Peoria & Pekin.—At a meeting of the stockholders on March 9 the present Board of Directors was re-elected.

Pennsylvania.—The two Assistant General Freight Agents have had their titles changed; Charles A. Chipley is now General Freight Agent in charge of local traffic, and John B. Thayer, Jr., is General Freight Agent in charge of through traffic. Since the promotion of Mr. Joyce there has been no General Freight Agent.

Pennsylvania Co.—D. T. McCabe, General Freight Agent of the Southwest System, at Columbus, O., has been appointed Freight Traffic Manager of the company, with headquarters at Pittsburgh, Pa., to succeed William Stewart, resigned. J. B. Hill, formerly General Western and Division Freight Agent of the Southwest System, at Chicago, has been appointed General Freight Agent at Columbus, O., to succeed Mr. McCabe. Both appointments will take effect April 1.

St. Louis & Hannibal.—At the annual meeting of stockholders, on March 9, the following Directors were elected: D. C. Blair, S. S. Palmer, M. T. Cox, C. Ledyard Blair, J. A. Jordan, W. C. Modisett and J. C. Thurman. The Directors have re-elected the following officers: S. S. Palmer, President; J. A. Jordan, Vice-President and General Manager; M. T. Cox, Secretary and Treasurer; J. M. Worland, Auditor; W. C. Modisett, Assistant Superintendent and General Freight and Passenger Agent.

St Louis & San Francisco.—G. W. Cale having resigned, the office of Freight Traffic Manager has been abolished and F. D. Russell, General Freight Agent, will assume the duties formerly ascribed to that office.

Stone Mountain.—At a meeting of the incorporators and stockholders of this proposed road in North Carolina, held on March 13, officers were elected as follows: President, George W. Hinshaw, Winston, N. C.; Vice-President, J. E. Stagg, Durham, N. C.; Secretary, E. M. Hinshaw; Treasurer, H. L. Smith; Chief Engineer, W. H. Wells, Washington, D. C. The Board of Directors is as follows: W. H. Wells, H. L. Smith, G. W. Hinshaw and J. E. Stagg. The principal office is at Winston, N. C.

Tennessee Coal, Iron & Railroad Co.—At the annual meeting of stockholders, held in Tracy City, Tenn., the following Directors were elected for the ensuing year: N. Baxter, J. T. Woodward, W. S. Gurnee, W. S. Gurnee, Jr., A. B. Boardman, C. C. Baldwin, James Swann, John G. Moore, Cord Meyer, J. J. McComb, Augustine T. Smythe, John B. Adger, Jr., David Roberts, A. M. Shook, C. M. McGhee, O. H. Payne and James Bowron.

Texarkana & Fort Smith.—At the annual meeting of stockholders, held in Texarkana, Tex., on March 9, the following officers were elected for the ensuing year: W. S. Taylor, President; A. E. Stilwell, First Vice President; William T. Hudgins, Second Vice-President; W. A. Williams, General Manager, Secretary, Treasurer and Auditor; Jacques T. Nolthenius, Assistant Secretary; A. L. Howe, Assistant Treasurer.

Toledo, St. Louis & Kansas City.—W. J. Scott has been appointed Assistant General Freight Agent, with headquarters in St. Louis, Mo., to succeed D. J. Jennings.

RAILROAD CONSTRUCTION,
Incorporations, Surveys, Etc.

Baton Rouge & Central Louisiana.—F. M. Welsh, the projector of this road, has announced that all financial arrangements have been made for its construction and that work will be begun shortly. The proposed line is from Baton Rouge in a general northwesterly direction, through Simmsport, Marksville and Alexandria, to the Texas state line in Vernon Parish. It is proposed to make connections with the St. Louis, Avoyelles and Southwestern at Simmsport.

Bellefonte Central.—The extension of this road from Struble, Centre County, Pa., south 4 miles to Pine Grove Mills has been completed, and the line was formally opened on March 11. The company proposes a still further extension of this line across the Tussey Mountain to Huntingdon, where connection will be made with both the Pennsylvania and the Bell's Gap Branch. It is reported that right of way for this extension has been voluntarily granted for almost the entire distance, and that $80,000 has been subscribed by the residents along the route.

Bruton & Pineora.—This road, which was formerly the Atlantic Short Line, has been given a new charter and has been reorganized. The road was originally proposed to extend from Macon, Ga., to Savannah, Ga., 180 miles. Previous to Feb. 1, 1896, 28 miles were completed from Bruton, Laurens County, southeast 28 miles to a point near Stillmore, Emanuel County. It is now proposed to continue the line from Stillmore, 57 miles, to Pineora, from which place it is expected to gain an entrance to Savannah over the Central of Georgia tracks. Several miles have been graded from Stillmore eastward toward Pineora, and rails are now being shipped. Bruton is about 50 miles southeast of Macon, but it is expected to make connections for reaching that city without building the entire distance.

Chattanooga Southern.—Surveys are now being made for a line to extend from Gadsden, Ala., south 115 miles to Montgomery, and it is expected that the line will be built by this company. The road is now in operation from Chattanooga, Tenn., south 92 miles to Gadsden.

Chicago, Hammond & Western.—Work is being pushed on the extension from La Grange, Ill., where connection is made with the Chicago, Milwaukee & St. Paul, north nine miles to Franklin Park, and the

company expects that the line will be completed by Oct. 1. The work is being done by the company.

Clarion, Hampton & Western.—This road, which was recently referred to in these columns under the Chicago Great Western, is proposed to extend from Hampton, Ia., the present terminus of the Chicago Great Western in that state, southwest 38 miles to Webster City, connecting at that point with the Crooked Creek Line, which runs from Webster City to the Lehigh coal fields. A survey of the line was made in the summer of 1895 by Mr. Trusedell, of St. Paul, and Mr. Wilson, of Webster City. Right of way for the line is now being obtained by representatives of the Des Moines & Northwestern Land & Loan Co., of Des Moines, which owns considerable land along the proposed route. Mr. V. O. Ford, Attorney for the Land Co., states that it is expected to secure a free right of way for the entire line, and that if such is obtained construction work will begun this spring.

Coahuila & Zacatecas.—A concession has been granted to Guillermo Purcell to build a railroad from Saltillo, state of Coahuila, southwest to Concepcion del Oro, state of Zacatecas, a distance of about 80 miles. Thirty kilometers (18.6 miles) must be completed within one year from June 12, 1897, and 30 kilometers more in each subsequent period of two years, the entire line to be completed by June 12, 1902. Mr. Purcell acquired an original concession for building this road in June, 1893, but it has since been modified several times.

Columbia Southern.—Articles of incorporation of this company were filed in Oregon on March 4. The capital stock of the company is $100,000. The proposed line is to extend from Biggs, Or., a station on the Oregon Railway & Navigation Co.'s line, south about 100 miles to Prineville, in Crook County, Ore. It is expected that construction work will be begun by May 1 at Biggs, and that the line will be pushed southwest nine miles to Wasco, Sherman County, this summer. Surveys between Biggs and Wasco have already been made.

Concord & Aberdeen.—It is announced that work is to begin shortly on this proposed road, which will connect Concord, N. C., with Aberdeen, N. C. The proposed route is 44 miles long, and passes through Mt. Pleasant, Big Lick and Little Mills, connecting with the Moore County road. Concord is a cotton center which is now reached only by the Southern.

Erie Eastern.—This company was chartered at Harrisburg, Pa., on March 16, to exist for 999 years. The company proposes building a road from the harbor of Presque Isle Bay, commonly called the harbor of Erie City, and from the city of Erie, in Erie County, Pa., to a connection with the Erie Railroad at or near Mill Village, Erie County, via the borough of Waterford, a total length of about 19 miles. The capital stock is $250,000. A. L. Tilden, Le Bœuf, Erie County, Pa., is President; the directors are given in another column.

Montgomery, Tuscaloosa & Memphis.—Surveyors are now at work in the vicinity of Blocton, Ala., locating a line for the proposed branch to tap the coal fields at that place. It is expected that connection will be made at Centerville with the main line between Montgomery and Columbus.

New Roads.—A line is proposed from Richmond, in the extreme eastern part of Indiana, southeast 20 miles to College Corner, Butler County, O., where connection will be made with the Cincinnati, Hamilton & Dayton. Preliminary surveys are now being made, and it is expected that active work will begin within a short time.

Ontario & Rainy River.—In two separate bills, passed in 1894 and 1895, the Canadian government has subsidized this road at the rate of $3,000 per mile for 80 miles; the sum of $240,000 remains untouched, however, the line being wholly unconstructed. Canadian papers now report that a further subsidy will probably soon be given at the same rate for the remainder of the route as proposed, and that English capitalists will then at once take up the project, and build the road. The line is proposed to run from a point on the Port Arthur, Duluth & Western, northwest, to Fort Frances, the objective point being Winnipeg. It is expected to open up a considerable gold mining region at Rainy Lake, on which Fort Frances is situated.

Pacific & Arctic Railway & Navigation Co.—Articles of incorporation of this company, which proposes building a road in Alaska, have been filed at Seattle, Wash. The capital stock is $1,000,000. The proposed route crosses Chilkat Pass, which will do away with the greatest hardship incident to the trip into the Yukon. It is also proposed to run boats on Summit Lake on the upper portions of the Yukon to carry passengers and supplies into the gold mining regions.

Pennsylvania.—Plans have been completed by Chief Engineer Dodd, of the Pittsburgh, Fort Wayne & Chicago, for elevating the tracks above the grade crossings in Allegheny, Pa. It is said that the new plans will necessitate raising the tracks 30 ft. above the present grade, bringing them on a level with the top of the Fort Wayne bridge. This will eliminate all grade-crossings as far as North avenue and Irwin avenue. It is reported that this improvement will cost at least $1,000,000, not including damages to private property along the line.

Pittsburgh, Cincinnati, Chicago & St. Louis.—The company has completed plans for an extension of the New Cumberland, W. Va., branch from its present terminus at New Cumberland to a point opposite East Liverpool, O., where a company has built a summer resort and new town, connected with East Liverpool by a bridge recently erected over the Ohio River. Work will begin within a few weeks.

Pittsburgh, Connellsville & Wheeling.—Surveys are being made for this road, which is proposed from a point near Millsboro, on the Monongahela River, up Ten Mile Creek via Waynesburg, and down Wheeling Creek to Wheeling, W. Va., a total distance of about 50 miles. J. L. Barrett is Chief Engineer. Local papers report that President Funk, of New York, and Secretary Douglass, of West Newton, Pa., are now contracting for the right of way. The road is expected to connect with the Pittsburgh, Virginia & Charleston at the Monongahela River.

Scalp Level.—The contract for this road, which is to connect Scalp Level, in Somerset County, Pa., with the South Fork branch of the Pennsylvania, at Lovett, Cambria County, has been given to Brown, Wells & McManus, of Philadelphia. It is proposed to push construction work as rapidly as possible, and so that the different sections of the line have been apportioned as follows: T. B. Brown will build the section from Lovett to Elton, Mr. Wells a second section from Elton northwest two miles, and Mr. McManus the balance of the line, about four miles. It is expected that work will be begun at once.

South Jersey.—The negotiations which have for some time past been under way for the completion of the branch into Ocean City, N. J., have been completed, and it is announced that the work will be pushed to completion at once. The branch leaves the main line at Petersburg, N. J., and will extend east eight miles to Ocean City. Work was begun last year, but was stopped by injunctions brought against the road by property owners along the proposed line. The branch will now be built by Philadelphia and Camden capitalists, and when completed will be leased to this company.

Texarkana & Shreveport.—It is generally reported that this road, which is now in operation from Texarkana, Ark., southeast 34 miles to Kiblah, is to be extended to Black River, Concordia County, La., by way of Shreveport and Coushatta, about 150 miles. At Black River connection could be made with the Natchez, Red River & Texas, which is a narrow gage line running east to Vidalia, 25 miles, connecting at that point with the Yazoo & Mississippi Valley. It is said to be the intention to change the Natchez, Red River & Texas to standard gage. The projectors claim that the road will pass through tracts of long leaf pine timber in Winn and Grant parishes, which would give the road a considerable freight business.

Texas Southern.—This company was chartered on March 12. The proposed line embraces 300 miles, including parts constructed, and extends from Red River, near Paris, in Lamar County, Tex., through Lamar, Red River, Delta, Hopkins, Franklin, Camp, Wood, Upshur, Gregg and Harrison Counties. Another line is proposed through Gregg Rusk, Panola, Shelby, San Augustine, Sabine, Jasper Newtown, Orange and Jefferson Counties to Sabine Pass. The capital stock is $300,000. The main business office is at Marshall. The Directors are E. Key, E. J. Fry, Y. D. Harrison, W. C. Peirce, Charles Cobb, Jr., J. P. Alford, T. C. Twyman, William Robertson and J. C. Womack, of Marshall, and D. H. Scott, John Martin and B. J. Baldwin, Jr., of Paris, Tex.

Washington County.—An injunction against this road, which has until the present time delayed construction work, has been dismissed, and it is proposed to begin work on the line at once, employing a large force of men, and to bring the work to completion as rapidly as possible. The proposed route is 120 miles long, and extends along the coast through Washington County in the eastern portion of Maine.

Electric Railroad Construction.

Altoona, Pa.—Some Altoona capitalists have projected a new electric line to run from the center of the city to Elmwood Park, a distance of five miles. The proposed capital stock is $75,000.

Baltimore, Md.—The Baltimore & Jerusalem turnpike has been formally turned over to a new company, the parties of which also have an interest in the Central Railway Co. An electric road has been proposed to connect with the lines of the Central Railway Co. in the northeastern section of Baltimore.

Belmar, N. J.—The Atlantic Coast Electric Railroad Co. has secured a franchise from the Belmar Council to construct, maintain and operate an electric road through certain streets of Belmar. The road is to be in running order on or before July 1 next. The terms are said to be $400 per year for the use of the streets. There appears to be some oppositions to the construction of the road.

Bowling Green, O.—Work has been progressing rapidly on the new electric road which is being built in Bowling Green. The line to the southern terminus of the city will be completed within a few weeks.

Bradford, Pa.—Preliminary work has been commenced on the Olean, Rock City & Bradford Electric Railroad. Ties are being distributed along the road and it is thought the line will be in operation some time in June.

Buffalo, N. Y.—The Buffalo Traction Co. has secured the consents of a majority of the property owners in streets covering 15 miles of the proposed new roads. The company is planning to build 30 miles of new track this year.

Plans for a car barn to be built by the Crosstown Street Railway Co. on the southeast corner of Hertel avenue and Military road have been filed with the Building Bureau. The building will be a one-story structure, 74 × 251 ft., ground dimensions. It will be built of brick with an iron roof, and will cost $15,000.

Catskill, N. Y.—A certificate has been granted to the Catskill Electric Railway Company by the New York State Railroad Commission to construct its road from Catskill Landing to Jefferson Heights, reference to which was made in our issue of Jan. 29.

Chatham, Ont.—The Chatham City & Suburban Railway is applying for a charter to extend its line to Roudeau, thence to Blenheim and Charing Cross, also to Wallaceburg and Petrolia.

City of Mexico, Mex.—The City of Mexico *Herald* of March 9 states that J. J. Moylan & Co. and the Albion Construction Co., of Chicago, have been awarded the contracts for building the Jalapa-Cordova narrow-gage electric road, which will be about 25 miles in length. The maximum grade will be about 3 per cent., and the power for operating the road is to be furnished by the falls near Jalapa.

Doylestown, Pa.—The Doylestown & Easton Street Railway Co. is securing the right of way to build an electric road between Doylestown and Easton. The officers of the company are H. J. Shoemaker, President; M. H. Stout, Secretary; Samuel A. Hellyer, Treasurer, and E. W. Keeler, Solicitor. S. J. Penrose, of Doylestown, and Joseph Leedom, of Philadelphia, are among the Directors.

Lansing, Mich.—It is expected that the roadbed of the proposed line along the St. Clair River will be finished by the end of May.

Nassau, N. Y.—The Greenbush & Nassau Electric Railway was incorporated with the Secretary of State on March 10 to operate a street surface road from Greenbush to Brainard Station, in the town of Nassau, Rensselaer County.

Natick, Mass.—The Wayland Selectmen have voted to grant a franchise to the Natick & Cochituate Street Railway Co. for authority to extend its tracks from Cochituate to Wayland Centre, a distance of about three miles. H. Harwood, of Harwood, Mass., is president of the company.

Newburyport, Mass.—The Newburyport & Amesbury Horse Railroad (operated by electricity) will be extended to West Newbury, connecting with lines to Haverhill,

New York.—Papers of incorporation were filed at Albany on March 13 for the New York & North Shore Railway Co., which proposes to build an electric railroad, with a capital stock of $1,000,000, on Long Island. The Directors include R. T. McCabe, W. R. Heath, G. H. Perkins, of New York; E. J. Matthewson and W. H. Shilmerdine, of Philadelphia; J. B. Bach, of East Orange, N. J., and C. S. Simpson, of Scranton, Penn. The tracks of the company will extend from Newtown to Jamaica and Hempstead. The principle office will be in Flushing, L. I.

The Third Avenue Railroad Co. has withdrawn its objections to the construction of the electric conduit lines as proposed by the Metropolitan Traction Co. The Railroad Commissioners have not as yet granted permission for the change of motive power, but will take final action in the matter in the course of a week or two. The business men on Eighth avenue have objected to any delay in the change on that line. It is not probable, however, that the company will tear up the streets this summer on all of the lines, which were shown on the map published in the *Railroad Gazette* of March 5, page 166.

Ottawa, Ill.—The Ottawa, Ill. Electric Railway, which suspended operation March 1st, 1896, has changed hands and is to be put in running order as soon as the weather permits. There was about four miles of line in the old road. Some changes will be made in its route and about two miles of track will be added.

Pittsburgh, Pa.—A charter was issued March 11 to the Monongahela Valley Traction Co., to build an 8-mile electric road in Washington County. The company is capitalized at $200,000. President, John D. Rively, Pittsburgh. Directors, F. W. Wentz, Charleori; James D. Irons, Wilkinsburg; W. W. Staub, Avalon; L. F. Wentz, Pittsburgh. President Rively holds 2,000 of the total 4,000 shares.

Pottstown, Pa.—The Ringing Rocks Electric Railway Co., of Pottstown, has just been granted right of way by the Town Council of Boyertown. The local company intends to extend its line from Ringing Rocks Park to New Hanover, and thence to Boyertown.

The Pottstown and West Chester Electric Railway Co. has made preparations for building an electric road from Pottstown to West Chester. The end of the line starts at South Pottstown and must cross the canal, and this morning a force of men commenced work on the excavations for the foundations of a new bridge.

Raleigh, N. C.—At a meeting of the Directors of the Raleigh Electric Co., held last Saturday, President A. A. Thompson was authorized to contract at once for five new electric cars, and for the building and apparatus of a power plant and arc electric light station. Under agreement with the city authorities the street cars must be in operation again by June 1.

Rockville, Conn.—The Hartfort, Manchester & Rockville Tramway Co. is building the Rockville extension between Talcottville and Dobsonville.

Sherbrooke, Que.—The Sherbrooke Electric Street Railway has given contracts for 500 poles, 200 of which the contractors will begin to deliver at once. The road to the exhibition grounds is expected to be finished by July 1, and the entire road in running order for August.

Tamaqua, Pa.—At a meeting of Town Council held March 4, an ordinance granting the Tamaqua & Lansford Street Railway Co. right of way on the streets of Tamaqua was passed. The company will be required to use a T-rail, and give a bond of $5,000. When finished, the road will connect Tamaqua and Summit Hill with the towns in the Panther Creek Valley.

Westchester, Pa.—A bill has been introduced in the Delaware Senate to incorporate the Wilmington & West Chester Electric Railway Co. by J. A. Bond, Thomas Mitchell, P. R. Clark and others, to operate an electric road between Wilmington, Del., and Westchester, a distance of about 18 miles. The capital stock is to be $200,000. The company proposes to carry passengers and freight over the road.

GENERAL RAILROAD NEWS.

Atchison, Colorado & Pacific.—A committe consisting of T. Jefferson Collidge, Jr., Oliver Ames, Edward H. Ladd, Jr., and James P. Pomeroy, has been formed at the request of holders of a large number of first-mortgage 6 per cent. bonds of this company and of the Atchison, Jewell County & Western, to act for the protection of their interests. An agreement has been prepared under which holders of said first-mortgage bonds are invited to deposit the same with the Old Colony Trust Co. in Boston, or the Union Trust Co. of New York, the limit of time of receiving such deposit being April 1. Both of these roads are leased by the Central Branch of the Union Pacific for 25 years, from 1879.

Atlanta & West Point.—The petition for a Receiver for this road, which was made last December, has been refused by Judge Lumpkin, Judge of the Superior Court, A. C., who has had the case under consideration. An injunction was granted restraining and enjoining the company until the final hearing of the case or further order of the Court to the contrary, from seeking to enforce or carry into effect the provisions of the act of the Legislature approved Dec. 19, 1896, touching a repeal of sections 7, 8 and 9 of the act of Dec. 27, 1847, or a repeal of section 1 of the act of Jan. 15, 1852, and also the provision for power to borrow money and execute deeds of trust or mortgages. The petition for a Receiver was made by L. B. Nelson on the ground that the charter for the road granted in December, 1866, had expired by its limitation of 30 years.

Chattanooga, Rome & Columbus.—Notice has been given by Simon Borg & Co., who bought in the road for the bondholders at its sale on Jan. 13, that a plan of reorganization has been prepared and filed with the Central Trust Co., of New York, and that a general meeting of the subscribers to the agreement of Sept. 5, 1895, will be held on April 8 for the purpose of making a disposition of the property.

Chicago, St. Paul, Minneapolis & Omaha.—Earnings for the year ending Dec. 31, have been reported as follows:

	1896.	1895.	Inc. or Dec.
Gross earn	$8,156,193	$7,508,764	I. $647,429
Oper. expen.	5,137,034	4,836,652	I. 300,382
Net earn.	$3,019,159	$2,672,112	I. $347,047
Int. and rentals.	1,519,299	1,535,878	D. 16,579
Balance	$1,499,860	$1,136,234	I. $363,626
Dividends	1,158 958	787,976	I. 370,982
Surplus	$340,902	$348,258	D. $7,356

In 1895 a 7 per cent. dividend was paid on preferred

stock, while in 1896, 7 per cent. was paid on preferred, and 2 per cent. on common stock. The greatest increase in gross earnings was in freight, which amounted to $5,983,440, as against $5,354,204 in 1895. This was due in a great measure to the larger grain shipments Passenger earnings fell off from $1,721,130 to $1,695,339, or about 1½ per cent. Maintenance of way expenses increased $377,727; transportation expenses increased $233,059; taxes increased $14,479; maintenance of equipment decreased $221,038, and general expenses decreased $3,846. Operating expenses, including taxes, were 62.98 per cent. against 64.41 per cent. in 1895.

Columbus, Hocking Valley & Toledo.—Judge Sage, of the United States Court, has issued an order authorizing Receiver Monsarrat to apply $85,000 of the trust fund on deposit with the State Trust Co., of New York, to the payment of interest due Feb. 1 on $2,500,000 first mortgage bonds.

Cuyler & Woodburn.—This road has been sold by J. S. Harold, United States Marshal, at Stilesboro, Ga. The road was bid in by A. A. Adams for $26,500. The line is 12 miles long, extending from Cuyler, a station on the Georgia & Alabama, 14 miles to Woodburn, 20 miles from Statesboro.

Gainesville, Jefferson & Southern.—Judge Kimsey, at Gainesville, Ga., has appointed Martin Dooly Receiver of this road, upon the application of Mr. Alexander, of Atlanta, Ga., one of the bondholders. The road has been operated for some time by the Georgia Railroad, and it is thought that the receivership is a preliminary proceeding toward complete control of the line by the Georgia. The road extends from Social Circle, 52 miles, to Gainesville, with a branch to Jefferson, in Jackson County.

Kansas City & Northern Connecting.—A certificate of increase of capital stock of this road from $2,000,000 to $3,000,000 was filed with the Secretary of State of Missouri on March 11. The road extends from North Kansas City to Smithville, 22 miles.

Louisville, New Albany & Chicago.—The road was sold under foreclosure at Indianapolis, Ind., on March 10, and was bought in by A. H. Joline, who represented the former owners, for $3,001,000. It is proposed to reorganize the company about May 1, as the Chicago, Indianapolis & Louisville. The present owners are Frederick P. Olcott, Henry W. Poor and Henry C. Rouse, a New York committee, representing the Central Trust Co. It is expected that the present officers will remain in their present positions after the reorganization.

Metropolitan West Side Elevated (Chicago).—At the request of the holders of a large amount of the first mortgage five per cent. bonds and of the capital stock of this company, Frederic P. Olcott, Walter G. Oakman and Samuel Thorne have consented to act as a committee for the protection of their interests and to prepare a plan of reorganization. The holders of bonds and stock have been requested to deposit their holdings with the Central Trust Co. of New York, under an agreement dated Jan. 30 1897, negotiable certificates of the Trust Co. to be issued for the deposited securities.

Middle Tennessee & Alabama.—A decree of foreclosure against the company, in the suit brought by the Central Trust Co., of New York, was granted on March 8 by Judge Lurton. The decree recites that on Dec. 19, 1893, the road, then known as the Decatur, Chesapeake & New Orleans, executed a deed of trust, which, with interest, now amounts to $263,563.24. This is the first mortgage, and is the first valid lien. The deed of trust also provided that when the payment of interest defaulted for 60 days, the bonds would be deemed to be at once payable on the application of one-third of the bondholders. Such default was shown to have been made, and the application was filed as provided. The sale will be made at Fayetteville, on a day to be named by the complainant. The upset price has been fixed at $100,000. All bidders must deposit $20,000 in cash with the court, which will be applied on the purchase price. The balance of the price may be paid in first mortgage bonds of the road.

Mobile & Ohio.—The negotiations looking to the extension of the road from Columbus, Miss., to Montgomery, Ala., have been completed by the sale of $4,000,000 five per cent. 50-year bonds, principal and interest payable in gold, and secured by a first lien upon the Montgomery division (the Montgomery, Tuscaloosa & Memphis), including two branches to the Warrior and Cahawba coal fields, and the equipment, to which the proceeds of a part of the bonds are to be applied. The building of this division will add about 200 miles to the company's system, and will give it an important terminus at Montgomery, where it will connect with the several railroads radiating from that center. The cost of the division and its equipment, including interest during construction, is covered by contracts, ensuring the application of the entire proceeds of the $4,000,000 bonds solely to that purpose.

New York Central & Hudson River.—Earnings for the three months and for the nine months ending March 31 are as follows (estimated in 1897):

	1897.	1896.	Inc. or Dec.	
Three months:				
Gross earn.....	$10,241,000	$10,283,911	D.	$42,911
Oper expen.....	7,013,000	7,029,328	D.	16,328
Net earn.....	$3,228,000	$3,254,583	D.	$26,583
First charges.....	2,628,000	2,644,528	D.	16,528
Profit.....	$600,000	$610,055	D.	$10,055
Dividend.....	1,000,000	1,000,000		.....
Deficit.....	$400,000	$389,945	I.	$10,055
Nine months:				
Gross earn.....	$33,179,000	$34,292,313	D.	$1,113,313
Oper. expen.....	22,507,000	23,218,487	D.	711,487
Net earn.....	$10,672,000	$11,073,826	D.	$401,826
First charges.....	7,892,000	7,923,030	D.	31,030
Profit.....	$2,780,000	$3,150,796	D.	$370,796
Dividend.....	3,000,000	3,000,000		.....
Deficit.....	$220,000	(surp.) $150,796	I.	$370,796

North Carolina.—Governor Russell has refused to obey the injunction served on him 10 days ago, forbidding him to make any change in the status of the road until the hearing, April 6. He has removed the old Board of Directors and notified President Alexander that he will be removed unless he at once resigns. Virgil S. Lusk, Charles A. Cook, A. W. Graham and W. H. Chadbourn have been appointed Directors on the part of the state; the remaining four, the Governor announces, will be named in a week or so. The two first named are the two men who, as members of the Legislature, managed the Governor's, or anti-lease, side of the controversy. The President and Directors removed by the new Governor are the parties defendant who, with the Attorney-General and the Governor, were served with the injunction papers in the equity suit, began by the New York Trust Company and the Southern, before Judge Simonton, of the United States Circuit Court last week. The Governor's action in removing them before the hearing of that case, has caused much surprise, and some lawyers declare he ought to be jailed for contempt of Court.

Pittsburgh, Ohio Valley & Cincinnati.—The Pennsylvania Company, operating this road, from Bellaire, O., to a point near Marietta, has announced that the road is indefinitely closed on account of the damage done by the flood of Feb. 22 in the Ohio Valley. The high water washed away much of the roadbed, while freshets, in small streams emptying into the Ohio River, carried away several long trestles and bridges. The work of repair is being pushed vigorously, but the line is not likely to be opened before Aug. 1.

Southern Pacific.—On March 10 a suit was brought against this company by the State of Kentucky, in which state the company is chartered, for $137,500, on account of the company's failure to make a statement of its business during the years 1893, 1894, 1895 and 1896, as required by the law taxing franchises. Attorney-General Taylor has been informed that the company will arrange a settlement at once.

Texas Central.—Judge L. W. Campbell, General Attorney for the company, has entered a motion in the United States Circuit Court to compel Wilbur F. Boyle, of St. Louis, to comply with his bid for the Waco & Northwestern Railroad, and to pay into court the sum of $1,505,(00, which was the amount of his bid made at the public sale two years ago. This motion is made in the interest of Moran Bros. and Henry K. McHarg, the purchasing trustees of the company. It is alleged in Judge Campbell's motion that the real purchaser of the Waco & Northwestern is Collis P. Huntington, and that Wilbur F. Boyle was merely Mr. Huntington's agent in the purchase. The motion recites that all excuses for delaying compliance with the purchase were recently removed by decrees entered in the United States Circuit Court at New Orleans, and that the failure to comply further would work a hardship on the creditors of the Waco & Northwestern, the owners of this road being among the creditors. The motion asks that Wilbur F. Boyle and Collis P. Huntington be cited to appear and show cause why there is further delay in producing the purchase money, and that if they cannot show cause they be required to do so at once.

Union Pacific.—It has been announced that a plan has been arranged by which the desire of certain note holders for immediate cash payment shall be met, and at the same time the remaining note holders and other parties (in consideration of an allowance of preferred stock of the reorganized company) shall arrange to take other collateral which is pledged for their present debt, and to liquidate the same within a definite period in such a manner as shall avoid any unnecessary disintegration of the company. An agreement has been reached between the Reorganization Committee and Messrs. J. P. Morgan & Co., trustees of the 6 per cent. collateral trust notes, whereby the notes shall be deposited with J. P. Morgan & Co., the depositor receiving a new certificate of $1,000 for each $1,000 note deposited. The deposited notes will be used for the purpose of foreclosing the present trust and of purchasing the collateral held thereunder. The securities so acquired are to be gradually liquidated for the purpose of redeeming the new certificates after paying six per cent. per annum thereon from Feb. 1, 1897. It is agreed that the reorganized company shall pay to each certificate holder 15 per cent. par value in its new preferred stock when issued. If, by Feb. 1, 1902, there shall not have been realized a sum in cash (in addition to said preferred stock) equal to the par of the new certificates with interest accrued to that date, then all the securities shall be sold and the proceeds applied toward such payment, or, if insufficient, then first to pay all interest, and second to make a ratable distribution on account of principal. The new certificates will be limited in amount to $8,488,000, the same as now outstanding. The committee, consisting of Messrs. Moore, Alexander and Atkins, recommend all note holders to deposit under this plan.

Utah Central.—Following the decree of foreclosure, reported in these columns last week, Judge Hiles has announced the appointment of George D. Loomis, Deputy Clerk of the Third District Court, as Master in Chancery to advertise and sell the property of the company, under the several decrees of foreclosure recently entered. Under his appointment, Mr. Loomis will now publish the 60 days' notice required by law for the sale of the real estate under execution, after which he will make the sale of the company's property, in accordance with the terms of the decrees of foreclosure.

Wilmington, Newbern & Norfolk.—On March 15 H. A. Whiting, of Wilmington, N. C., was appointed Receiver of this road by Judge J. H. Simonton, Judge of the Circuit Court of the United States, at Charleston. The receivership was caused by the application of John D. Bellamy, of Wilmington, Attorney for the State Trust Co., of New York, Trustee of the mortgage bondholders. The mortgage debt of the company is about $1,250,000. The road extends from Wilmington to Newbern, N. C., 87 miles.

Electric Railroad News.

Bridgeton, N. J.—The South Jersey Traction Co. was sold for $90,000 at Master's sale, on March 11, to F. L. Lewis, of Philadelphia, Trustee, representing the syndicate of the old company. The sale included the Bridgeton & Millville electric line, with all the appurtenances of street railroads in both cities.

Dallas, Tex.—A press despatch states that on March 12 Judge Smith granted a petition for a Receiver for the Dallas City Street Railway Co., applied for by the Mercantile Trust Co., of Baltimore, which holds $250,000 worth of the company's bonds on which default of interest has been made.

Hudson, N. Y.—Congressman A. V. S. Cochrane, acting for Messrs. William H. Traver and Smith Thompson, purchased the Hudson Electric Railway, sold under foreclosure proceedings on March 6. It is probable that a new company of capitalists from Hudson and vicinity will be formed to operate the road. The capital stock was $50,000, and the length 1¾ miles.

Stillwater, Minn.—The Stillwater Street Railway Co. was sold March 6 to F. A. Flint, of Stillwater, for $4,700. It is stated that improvements will be made and that cars will again be operated.

Warren, Pa.—The following directors have been elected by the stockholders of the Warren Street Railway: J. D. Woodward, W. W. Rankin, W. R. Lavery, Dr. John Hepburn and D. H. Siggins. The following officers have been elected: Secretary, W. W. Rankin, and Treasurer, D. H. Siggins.

TRAFFIC.

Traffic Notes.

In a single day recently the Western & Atlantic delivered in Atlanta 167 carloads of freight for export, via Charleston.

The Galveston Wharf Co. has voted to reduce the wharfage on cotton from 10 cents a bale to 7½, the reduction to go into effect September 1.

The Receiver of the Union Pacific, Denver & Gulf has contracted with the Pacific Express Co. to do the express business on that road as long as it is in the hands of a Receiver.

The Interstate Commerce Commission held an inquiry in New York on Monday and Tuesday of this week concerning the rates on export grain from the West, which have been complained of by the New York Produce Exchange as inequitable.

The movement of export freight over the Chesapeake & Ohio is now so heavy that the transfer facilities at Newport News are severely taxed. Large numbers of cattle are sent to Europe over this road. A reporter states that Mr. Ingalls tells him that a large new grain elevator will soon be built at Newport News.

Sousa's band, of New York, now making a tour of the Western States, is traveling on an itinerary which extends over 24 weeks, during which time there are only three days on which no concert is given, two between San Francisco and Portland and one between Helena and Fargo. This company stops only at the largest towns and cities.

The Interstate Commerce Commission has decided that the passenger fare between Seligman, Mo., and Eureka Springs, Ark., now 10 cents a mile, is too high and should be reduced to $1.20, equal to 6¼ cents a mile. It appears that the local rates on the road (the Eureka Springs Railway Co.) are five cents a mile in Arkansas and four cents in Missouri. Commissioner Knapp dissents from this opinion of the commission.

Complaint having been made to the Interstate Commerce Commission by shippers of vegetables from Gainesville, McIntosh and other Florida points to New York that rates now charged are unreasonable and that they are relatively higher than those to Chicago, and that the rates to New York are much higher than those in force 10 years ago, although the traffic is now many times greater, the Commission will have a hearing at Jacksonville, Fla., on April 9.

Decision in the New York Milk-Rate Case.

The Interstate Commerce Commission has announced its decision in the case of the Milk Producers' Protective Association against the Delaware, Lackawanna & Western, the Erie, and other lines carrying milk for the New York market. The complaint alleged that the carriers' practice of charging uniform rates of 32 cents on milk and 50 cents on cream per can of 40 quarts from all shipping stations on their respective lines, without regard to distance, was unlawful. The Commission decides that the uniform rates complained of are unduly prejudicial to producers nearer New York, and that for this traffic there should be at least four divisions of stations, namely: The first group should extend 40 miles out from the terminal; the second should embrace stations within the next 60 miles; the third group should include points within the next 90 miles, and the fourth group should cover stations beyond 190 miles from the terminal. The rates on can milk should not exceed 23 cents for the first or 40-mile group; 26 cents for the second or 60-mile group; 29 cents for the third or 90-mile group, and the present rate of 32 cents is held not to be unreasonable from stations in the fourth group. A rate which is 18 cents greater per can on cream than on milk, the present difference, is held to be not unreasonable. The third or 60-mile group is reduced to 30 miles for the Ulster & Delaware road, and the group distances are required to be reckoned according to the short-distance routes from stations on the Wallkill Valley, and Lehigh & Hudson River roads, and the Jefferson branch of the Erie. No order is made as against the New York, New Haven & Hartford, the rates on which road are now much lower than those determined lawful for the other carriers.

Chicago Traffic Matters.

CHICAGO, March 17, 1897.

Second-class passenger rates to New York are being cut by the new lines to the East—the Louisville, New Albany & Chicago; the Cincinnati, Hamilton & Dayton; the Baltimore & Ohio Southwestern, and the Baltimore & Ohio. Tickets have been sold at $15, the authorized rate being $17. The deal has been carried through by the assistance of a steamship broker here, who was given a $3 commission. Further than this, the brokers are using the tickets to scalp Cincinnati and Washington business.

The Chicago Live Stock Exchange has filed a complaint with the Illinois Railroad Commission against 19 roads, claiming that the live stock rates in Illinois are unreasonably high.

A story is current here that a detective of the Interstate Commerce Commission has been among the dairy and live poultry shippers in Nebraska, Missouri, Kansas and Iowa, and by representing himself as agent of a supposed fast freight line has succeeded in securing evidence of manipulation of freight rates.

Eastbound shipments from Chicago and Chicago Junctions to points at and beyond the Western termini of the trunk lines for the week ending March 11 amounted to 112,378 tons, as compared with 120,397 tons the preceding week. This statement includes 60,342 tons of grain, 11,857 tons of flour and 10,316 tons of provisions, but not live stock. The following is the statement in detail for the two weeks:

Roads.	WEEK ENDING MAR. 11.		WEEK ENDING MAR. 4.	
	Tons.	p. c.	Tons.	p. c.
Baltimore & Ohio.....	6,522	5.8	6,398	5.3
C., C., C. & St. Louis.....	8,121	7.2	9,232	7.7
Erie.....	12,265	10.9	10,283	8.5
Grand Trunk.....	10,497	9.4	10,737	8.9
L. S. & M. S.....	15,894	14.2	14,803	12.3
Michigan Central.....	16,887	15.0	14,551	12.1
N. Y., Chi. & St. L.....	13,299	11.8	19,590	16.3
Pitts., Cin., Chi. & St. Louis.	9,943	8.9	10,693	8.9
Pitts., Ft. Wayne & Chicago	12,037	10.7	15,422	12.8
Wabash.....	6,913	6.1	8,688	7.2
Totals.....	112,378	100.0	120,397	100.0